**Africa RISING West Africa Project**

**2020/2021**

**Ghana and Mali Workplans**

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| August 2020 | |

[www.africa-rising.net](http://www.africa-rising.net)

The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-in-development projects supported by the United States Agency for International Development as part of the U.S. government’s Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program’s monitoring, evaluation and impact assessment. <http://africa-rising.net/>

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# Summary

The Africa RISING West Africa (WA) project is being implemented by multi-disciplinary research teams and development partners from the public and private sector in collaboration with farmers and community-based organizations in northern Ghana.

This document presents the work plans for the 2020-2021 research year for Ghana. The activities and sub-activities are mapped under the four Outcomes in the [Africa RISING West Africa Project Phase 2 logframe](#_Africa_RISING_West). Twenty-eight (34) sub-activities are being implemented in the Ghana workplan, while sixteen (18) are being implemented in the Mali workplan. The distribution of the 52 sub-activities per outcome is as presented in Table 1 below.

**Table 1:** Distribution of sub-activities per West Africa project logframe outcome

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Country** | **Outcome 1** | **Outcome 2** | **Outcome 3** | **Outcome 4** |
| Ghana | 14 | 5 | 6 | 9 |
| Mali | 10 | 1 | 2 | 5 |

Linkages between activities, gender mainstreaming, capacity building and knowledge exchange and dissemination are embedded within all sub-activity plans. Publication of research results and better communication among research teams within and across countries will be a major focus.

# Background

Phase 1 (1 October 2012 - 30 September 2016) of the USAID-funded Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) project in West Africa (WA) was implemented in 25 intervention communities in northern Ghana and 9 villages in the Bougouni and Koutiala districts of the Sikasso Region in southern Mali under the *title 'Sustainable Intensification of Key Farming Systems in the Guinea-Sudano-Sahelian Zone of West Africa'*. Research activities under Phase 1 were organized around 3 research outputs (ROs), namely: 1) Situation analysis and program-wide synthesis (RO1); 2) Integrated Systems Improvement (RO2) and 3) Scaling and Delivery (RO3). Capacity building and gender were cross-cutting. Phase 2 (1 October 2016 - 30 September 2021) of the WA project was launched in February 2017.

Technological packages and/or practices validated in Phase 1 (see Table 2) are being scaled out targeting agro-ecosystems and socio-economic circumstances defined by the sustainable intensification (SI) domains - productive, economic, social, human and environmental. Linkages will be established with research and development partners to undertake both generic and back-stopping research. The generic research aims at completing the loose ends of research on the SI innovations in Phase 2 plus any other emerging issues. The back-stopping research will address researchable issues emerging from the scaling-out of SI innovations with the development partners.

Phase 2 is also exploring new research areas emerging from Phase 1 experiences and feedback by research and development partners, notably, using results from farming systems analyses and farm types to inform research targeting and technology dissemination; post-harvest management and value addition; nutrition-sensitive agriculture; labour-saving mechanization solutions for small-scale farmers; and climate-smart agriculture.

# Table 2: **List of validated technologies ready for promotion through development partners in Ghana and Mali**

| **Broad category** | **Validated flagship technology** | |
| --- | --- | --- |
| **Ghana** | **Mali** |
| Introduction of new crops and varieties to overcome existing biotic and abiotic stresses and improve productivity per unit land area. | New varieties – drought-tolerant maize, rice, aflatoxin resistant groundnut, sorghum hybrids, early-maturing cowpea, dual-purpose cowpea, short-duration soybean, medium soybean, high yielding and disease-resistant varieties of improved vegetables (okra, roselle, tomato, eggplant and pepper) | High performing and dry season-adapted and farmer preferred vegetable varieties of okra (Konni), African eggplant (L10), Tomato variety (Rio Grande)  Aflatoxin resistant groundnut, early-maturing groundnut  Sorghum hybrids (Pablo, Fadda and Sewa), dual-purpose sorghum (Soubatimi, Tiandougou Coura, Jiguikala and Peke) |
| Agronomic practices to improve grain and fodder yield per unit land area and improve soil nitrogen. | Cereal-legume intercropping  Cereal-legume rotations  Dual-purpose food legumes  Cereal-vegetable intercropping  Cowpea living mulch (Maize cowpea intercrop for NRM and fodder support at household level  Optimal groundnut spacing  Maize leaf stripping for grain and fodder provision. | Cereal-vegetable intercropping (tomato, pepper)  Cereal-legume intercropping (groundnut)  Dual-purpose food legumes |
| Integrated soil fertility management as a cost-effective approach to replenish soil fertility. | Optimized N and P fertilizer rates  Fertilizer micro-dozing  Livestock corralling for manure/urine  Cereal-legume rotations  Cereal-legume intercropping | Fertilizer micro-dosing, composting  Cereal-vegetable intercropping (tomato, pepper)  Cereal-legume intercropping (groundnut) |
| Improved livestock feeds and feeding, housing, health and breeding management packages. | Sheep/goat flock feeding package  Sheep/goat health package  Housing and feeding for poultry  Guinea fowl hatching and brooding management  Stover quality improvement  Improved livestock feed troughs for small ruminants | Stover quality improvement using feed chopper |
| Introduction of pre- and post-harvest technologies to reduce food waste and improve food safety. | Storage – PICS bags, plastic drums  Aflasafe application  Maize shellers for postharvest support |  |
| The use of natural resources management as a means to preserve soil and water. | Soil and water conservation measures (e.g. contour bunding, ridge planting, cowpea living mulch) |  |
| Introduction of improved land and water management systems |  | Contour bunding associated with fast-growing tree species |
| Seed treatment |  | Apron Star 42WS |

# West Africa Project logframe overview

An overview of the Africa RISING West Africa Project logframe up to the activity level can be glanced from Table 3 below. All sub-activities initiated by project partners align with specific outcomes, outputs and activities within the logframe. Activities listed in italics within the table are those which have an ongoing sub-activity within this year’s (2020/2021) workplan in both Ghana and Mali. For a detailed look at other important logframe elements like objectively verifiable indicators, sources and means of verification, the assumptions for each output etc. the complete project logframe document is accessible at: <https://hdl.handle.net/10568/82851>.

# Table 3: Logframe overview (Sub-activity titles in Tables 3.1 & 3.2)

|  |  |  |
| --- | --- | --- |
| **Outcomes, Outputs and Activities** | | **Ghana Sub-activities for 2020/2021** |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | |  |
| Output 1.1: Research products for more productive, intensive, diverse, profitable and resilient crop (cereals, legumes, and vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners. | *Activity 1.1.1: Test and disseminate a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production.* | *GH1112-20*  *GH1113-20*  *GH1115-20*  *GH1116-20*  *MA1111-20*  *MA1112-20*  *MA1113-20*  *MA1114-20* |
| *Activity 1.1.2: Test and disseminate a combination of improved breeds, housing, feeding, health and breeding practices to intensify rearing of livestock (sheep, goat, pig, and poultry) for meat, egg and milk production.* | *GH1121-20*  *GH1122-20*  *GH1123-20*  *MA1121-20*  *MA1122-20* |
| *Activity 1.1.3: Test and disseminate integrated crop-livestock-soil and agroforestry systems to increase and sustain productivity and reduce risk.* | *MA1131-20* |
| Output 1.2: Integrated management practices and innovations to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated with farmers and development partners in the intervention communities. | *Activity 1.2.1: Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and ecosystems services at the farm and landscape/watershed levels.* | GH1211-20  GH1212-20  MA1211-20  MA1212-20 |
| *Activity 1.2.2: Test and promote water management technologies and practices to increase water productivity in the small-scale crop-livestock farming systems under rain fed and irrigated conditions.* | GH1221-20  MA1221-20 |
| *Activity 1.2.3: Test and promote integrated soil fertility and integrated pest management technologies and practices to increase and sustain productivity and reduce risk.* |  |
| Output 1.3: Labor-saving and gender-sensitive technologies in target areas to reduce drudgery while increasing labor efficiency in the production cycle delivered. | *Activity 1.3.1: Train local partners on appropriate use of drudgery-reducing technology delivery.* |  |
| *Activity 1.3.2: Introduce, test and adapt existing pre-harvest small-scale mechanization options to farmers and partners in the intervention communities.* |  |
| *Activity 1.3.3: Demonstrate small-scale maize shelling machines to smallholders and other stakeholders to reduce drudgery and labor requirements* |  |
| Output 1.4: Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated into capacity development (and used in outcomes 4 and 5). | *Activity 1.4.1: Generate technology extrapolation domains in West Africa.* | GH1411-20  GH1412-20 |
| Outcome 2: More farmers and farm families are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition. | |  |
| Output 2.1: Improved technologies, innovations, practices and habits to increase production and consumption of safe diverse and more nutritious food for farm families, especially by women and children developed and disseminated in partnership with research and development partners. | *Activity 2.1.1: Develop a nutrition strategy to harmonize the nutrition activities with national nutrition approaches and link them to the crop and livestock activities.* |  |
| *Activity 2.1.2: Train farm families, especially women to produce and consume diverse and more nutritious food.* | GH2122-20  GH2123-20 |
| *Activity 2.1.3: Use nutrition focused activities as an entry point for greater involvement of younger women and the youth in the production and consumption of diverse and more nutritious foods.* |  |
| Output 2.2: Postharvest technologies and practices to provide options for the food, and feed sectors are tested and disseminated to farmers, through researchers, extension staff, and development partners. | *Activity 2.2.1: Introduce, evaluate, adapt and disseminate existing postharvest technologies and practices* | GH2211-20  GH2212-20  *MA2211-20* |
| *Activity 2.2.2: Build capacity of farm families to reduce postharvest losses.* |  |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | |  |
| Output 3.1: Enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners. | *Activity 3.1.1: Review existing policies and institutional arrangements affecting equitable access to production assets and markets.* | *GH3111-20*  *GH3112-20*  *MA3111-20* |
| *Activity 3.1.2: Assess the level of inclusiveness of women and the youth along crop and livestock value chains.* |  |
| *Activity 3.1.3: Advocate enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets.* |  |
| Output 3.2: Options to expand accessibility of production assets and increase participation in house-hold decision-making by disaggregated groups by gender. | *Activity 3.2.1: Identify constraints to, and opportunities for increasing women and youth access to production assets in the target area.* | *GH3211-20*  *GH3212-20*  *MA3212-20* |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI, technologies, innovations and practices. | |  |
| Output 4.1: Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | *Activity 4.1.1: Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts.* | *GH4111-20*  *GH4112-20*  *GH4113-20*  *GH4114-20*  *MA4111-20* |
| *Activity 4.1.2: Map and assess relevant stakeholders to establish dialogue for the exploration of mutual synergies for scaling delivery of validated technologies.* | *GH4121-20*  *GH4122-20* |
| *Activity 4.1.3: Leverage/link and integrate (engagement and outreach) with existent initiatives including Government extension systems to support and encourage the delivery pathways.* |  |
| Output 4.2: Gender-sensitive decision support tools to assess technology-associated risks and opportunities are available for use by project partners. | *Activity 4.2.1: Identify and communicate gender-sensitive decision support tools in the context of different farm typologies.* |  |
| Output 4.3: An updated framework for monitoring technology adoption to be used by the project team and scaling partners available and accessible | *Activity 4.3.1: Monitor and report technologies and their associated beneficiaries or farmers exposed to the innovations using the tools developed by IFPRI.* | *GH4311-20*  *GH4312-20*  *GH4313-20*  *MA4311-20*  *MA4312-20*  *MA4313-20* |
| *Activity 4.3.2: Make these reports available on the Africa RISING repositories.* |  |
| Output 4.4: Knowledge sharing centers (physical structures) and learning alliances are developed within existing local and regional institutions | *Activity 4.4.1: Establish knowledge-sharing and learning alliances among scaling actors.* | *MA4411-20* |

# Table 3.1: Ghana **Sub-activity numbers and titles**

|  |  |
| --- | --- |
| Sub-activity # | Sub-activity title |
| GH1111-20 | Follow-up on gender evaluation of cowpea living mulch intervention |
| GH1112-20 | Optimizing on-farm nitrogen (N) use efficiency under rainfed condition in maize-based cropping system |
| GH1113-20 | Assessing the potential for a combination of local Napier fodder species and pigeon peas for improved soil health, ruminant productivity and market potential of both Napier and Pigeon pea fodder in the Guinea savannah zone; and Investigating opportunities and constraints for fodder cultivation and trade (Napier and Pigeon pea), specifically women’s and youth market participation in this part of the livestock value chain. |
| GH1114-20 | Currently become GH4122 (SARI sub-activity) |
| GH1115-20 | Identify varieties and post-harvest management options of vegetable crop species with adaptation to Northern Ghana in the dry season |
| GH1116-20 | Determine yield and post-harvest quality of vegetables as affected by improved soil and water management practices in the dry season in Northern Ghana |
| GH1121-20 | Efficient feed utilization through improved feed troughs |
| GH1122-20 | Synthesize previous work on feed and health interventions for improved small ruminant production in Northern Ghana |
| GH1123-20 | Assess the effect of feeding maize leaf stripping on digestibility and growth performance of small ruminants and interactions of the technology with child labor (more specifically herding of small ruminants) and school attendance of boys and girls |
| GH1211-20 | Assessing buffer and adaptive capacity to harness the resilience of different farm types |
| GH1212-20 | Assess the impact of soil and water conservation interventions in a maize - cowpea living mulch system |
| GH1221-20 | Evaluate the technical and agronomic performance of Bhungroo and solar-energy drip irrigation system in the Upper East Region of Ghana |
| GH1411-20 | Produce regionally relevant extrapolation domain maps for validated integrated technology packages. |
| GH1412-20 | Identify the sustainable agricultural intensification technologies and household characteristics that determine the maize grain yields at the different technology extrapolation domains. |
| GH2121-20 | Container gardening training combined with nutrition education for increased vegetable consumption |
| GH2122-20 | Improving Child and Maternal Nutrition through Home Container Vegetable Gardening |
| GH2123-20 | Engaging Men to Increase Support for Optimal Child Feeding Practices Using Care Group Approach |
| GH2211-20 | Evaluate the threshing efficiency of different maize shellers with regards to grain quality characteristics as influenced by different varieties and harvest timing |
| GH2212-20 | Monitoring group dynamics among users of small-scale maize shelling machines in Northern Ghana |
| GH3111-20 | Strengthen the technical, managerial and organizational capacities of the major actors in small ruminants value chain through existent institutional structures such as Farmer-Based Organizations (FBO), District Assemblies (DA), Community Based Organizations (CBO), traders Associations, Transports and input Dealers Association |
| GH3112-20 | Analyze the enabling environment including policies and institutional arrangements and intervention to identify factors that enable the inclusion of women and youth along irrigated vegetable value chain |
| GH3121-20 | Assessing the inclusiveness of women and youth within the vegetable production value chain to enhance vegetable production among small holder farmers. |
| GH3122-20 | Assess women and the youth participation in maize and small ruminant value chains in project communities and markets the communities are linked to |
| GH3211-20 | Evaluate risk and vulnerability as well as resilience attributed to Africa RISING interventions within smallholder farming systems in relation to wellbeing and livelihoods. |
| GH3212-20 | Co-identify value chain-based scaling pathways for irrigation technologies and water solutions with farmers and other actors of vegetable value chains in the Africa RISING sites in Mali and Ghana and link these sites and activities to ILSSI’s multi-stakeholder Dialogue Space on small scale irrigation in Ghana |
| GH4111-20 | Conduct simulation and other socio-economic analyses of selected SI technologies/practices for different farmer contexts, to have a better understanding of the adoption potential of these proven technologies and opportunities for scaling up. |
| GH4112-20 | Evaluate the impact of SI practices on household welfare, poverty, perceived shock, the environment, and food and nutrition security in northern Ghana |
| GH4113-20 | Provide safety nets to smallholder farmers through crop insurance while developing a business model with multi-stakeholder partners for scaling validated technologies for equity and empowerment |
| GH4114-20 | Evaluate farmers’ preferences for technology attributes and their associated benefits in cereal-legume systems of northern Ghana. |
| GH4121-20 | Utilize ICT and GIS tools as a means to share information (agronomic, climatic and market services) and scale-out Africa RISING technologies in collaboration with strategic partnerships in the region |
| GH4122-20 | Promotion and dissemination of Africa RISING SI interventions for sustained productivity and reduced risk in Ghana using the climate-smart village approach |
| GH4311-20 | Matching agricultural technologies to farms and their context |
| GH4312-20 | Investigate the distribution of benefits from diverse agricultural interventions |
| GH4313-20 | Addressing constraints limiting adoption of SI technologies as a result of competing interests for natural and other household resources |

# Table 3.2: Mali Sub-activity numbers and titles

|  |  |
| --- | --- |
| Sub-activity # | Sub-activity title |
| *MA1111-20* | Evaluating crop simulation models using different fertility sources and climate model outputs to improve the productivity of sorghum. |
| *MA1112-20* | Understanding soil fertility management in cereal cropping systems in southern Mali |
| *MA1113-20* | Testing adaptation of dual purpose sorghum hybrids in Mali to diversify options for crop-livestock integration. |
| *MA1114-20* | Evaluate and disseminate diseases, pests, postharvest and nutrition support technologies tested in 2019 to reduce pre- and postharvest losses and improve nutrition under rainfed and dry seasons. |
| *MA1121-20* | Evaluate efficient feed utilization through improved feed troughs. |
| *MA1122-20* | Demonstrate and promote fodder production for improved ruminant productivity. |
| *MA1131-20* | Risk management and informed decision making towards sustainable intensification of crop-livestock systems. |
| *MA1211-20* | Assess cropping management factors using empirical relations, GIS and Remote Sensing tools in two agro-ecologies of Mali. |
| *MA1212-20* | Improving crop-livestock productivity and household income through the use of contour bunding and agroforestry options. |
| *MA1221-20* | Evaluate improved irrigation technologies for efficient and sustainable agricultural water management in rural Mali. |
| *MA2211-20* | Reduce vegetable postharvest losses through dissemination of Zero Energy Cool Chamber (ZECC) and processing of vegetables and capacity building in dry season in Bougouni and Koutiala. |
| *MA3112-20* | Analyze the enabling environment including policies and institutional arrangements and intervention to identify factors that enable the inclusion of women and youth along irrigated vegetable value chain |
| *MA3212-20* | Co-identify value chain-based scaling pathways for irrigation technologies and water solutions with farmers and other actors of vegetable value chains in the Africa RISING sites in Mali and Ghana and link these sites and activities to ILSSI’s multi-stakeholder Dialogue Space on small scale irrigation in Mali |
| *MA4111-20* | Determine farmers’ preferences of technology attributes in cereal-legume systems of southern Mali. |
| *MA4311-20* | Sustainable intensification in mixed crop and livestock systems and natural resource governance in southern Mali – Synthesis of interventions. |
| *MA4312-20* | Assess the impact of Innovation Platforms on SI technology uptake in Africa RISING interventions communities |
| *MA4313-20* | GIS mapping of implemented technologies across different agro-ecologies and gender influence in technology adaptation and use in Bougouni and Koutiala districts of Mali |
| *MA4411-20* | Manage the operations of four technology parks as hubs for research and demonstration in Bougouni and Koutiala. |

# Table 4. Ghana and Mali Partners and their responsibilities

| **Name** | **Abbreviation** | **Ghana** | **Mali** | **Role/responsibility** |
| --- | --- | --- | --- | --- |
| **Government Ministries & Entities** |  |  |  |  |
| Ministry of Food and Agriculture | MoFA | + |  | Scaling-out SI technologies and establishment of R4D platforms |
| Ministry of Health (Ghana Health Services) | MoH (GHS) | + |  | Household nutrition R4D with UDS and IITA; Assist with training of women’s groups on nutrition education, data collection & compilation of reports on activities |
| Ghana Irrigation Development Authority | GIDA | + |  | Potential scaling partner for irrigation technologies with IWMI |
| Veterinary Services Division | VSD | + |  | Animal health, capacity building community health workers with Animal Research |
| Institut d’Economie Rurale | IER |  | + | Socioeconomic and on-farm studies with ICRISAT |
| Regional Direction of Agriculture in Sikasso | DRA-Sikasso |  | + | Scale-out provision of secondary data on socioeconomics |
| **Academic/National Research Institutions** |  |  |  |  |
| University for Development Studies | UDS | + |  | Research on livestock nutrition and human nutrition, Graduate training and R4D |
| Science and Technology Policy Research Institute | STEPRI | + |  | Policy review and analysis |
| Institut Polytechnique Rural de Formation et de Recherche Appliquée Katibougou | IPR-IFRA |  | + | Polytechnic for rural education and applied research |
| Kwame Nkrumah University of Science and Technology | KNUST | + |  | Graduate student training, research on soil water dynamics |
| Animal Research Institute | ARI | + |  | R4D on livestock production (sheep and goats) with ILRI |
| **International Research Institutions** |  |  |  |  |
| International Crops Research Institute for the Semi-arid Tropics | ICRISAT | + | + | Sorghum/millet−groundnut R4D with IITA and SARI |
| International Food Policy Research Institute | IFPRI | + | + | Surveys, and monitoring and evaluation |
| The World Vegetable Center | WorldVeg | + | + | Lead R4D on vegetable production systems |
| International Institute of Tropical Agriculture | IITA | + | + | Project coordination and R4D research on cereal−legumes. |
| International Livestock Research Institute | ILRI | + | + | Lead R4D on livestock, especially ruminants |
| International Water Management Institute | IWMI | + |  | Lead R4D on water management |
| Wageningen University, The Netherlands | WUR | + | + | R4D on farming systems and graduate training |
| International Center for Tropical Agriculture | CIAT | + |  | Research on land and soil management |
| **Nongovernmental Organizations** |  |  |  |  |
| Centre d’Appui a l’Autopromotion pour le Développement | CAAD |  | + | Scaling out groundnut technologies. Assisting implementation of animal health and fattening program by ILRI and IER. |
| Fédération Nationale pour l'Agriculture Biologique et Équitable | FENABE |  | + | Scaling-out, capacity building, community mobilization, on-farm research |
| Association Malienne d’Eveil et de Développement Durable | AMEDD |  | + | On-farm field trials and household nutrition studies with ICRISAT |
| Le Groupe de Recherches d’Actions et d’Assistance pour le Développement Communautaire | GRAADCOM |  | + | Scaling out groundnut technologies. Assisting implementation of animal health and fattening program by ILRI and IER. |
| CARE International | CARE-MALI |  | + | Disseminate Africa RISING validated technologies in 12 watersheds that constitute 82 villages in Mopti region |
| **Private Organizations and Development Projects** |  |  |  |  |
| Community-based Organizations | CBOs | + | + | On-farm implementation of R4D activities |
| Peace Corps | Peace Corps | + |  | Introduce Africa RISING Technologies to communities they work in |
| Seed Producers Association of Ghana | SEEDPAG | + |  | Seed production and training of farmers for quality declared seed |
| WorldCover | WorldCover | + |  | Indexed based agricultural insurance. Co-sharing of farmers in some communities provides synergies. |
| **Feed the Future Innovation Labs** |  |  |  |  |
| Sustainable Intensification Innovation Lab | SIIL | + |  | Co-share materials, concepts and approaches to conducting research e.g. use of the Sustainable intensification Framework |
| Soybean Innovation Lab | SIL | + |  | Sharing knowledge and approaches towards post-harvest mechanization in communities |
| Innovation Lab for Legume Systems Research | ILLSR | + |  | Acting as liaison between the Mission Office and the Innovation lab and conducting joint research activities |
| Innovation Lab for Small Scale Irrigation | ILSSI | + |  | Co-location of sites with Africa RISING work and sharing knowledge, approaches, sites and personnel e.g. with IWMI |

## Ghana Planned work

The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project logframe (Table 3).

**2. Planned work**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1111-20** | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | | |
| b. Activity 1.1.1 | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production | | | | | | | | | | | | |
| c. Sub-activity GH1111-20 | | | Follow-up on gender evaluation of cowpea living mulch intervention | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | | | | Institution | | | Role | | | | | | |
| Gundula Fischer | | | | | | IITA | | | Social scientist, activity leader, development of tools and data analysis | | | | | | |
| Kipo Jimah | | | | | | IITA | | | Gender specialist, development of tools, data collection and data analysis | | | | | | |
| Abdul Rahman Nurudeen | | | | | | IITA | | | Agronomist, assessment of productivity dimension | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | Degree | | Start | | End | |
| Nil | | | |  | | | | | |  | |  | |  | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | |  | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | October 2020 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| In 2019 the Africa RISING gender team conducted an evaluation of the cowpea living mulch intervention with male and female farmers. Data have been processed and analyzed. The activity proposed here is a follow-up study with the following objectives: to validate the results of the 2019 study (specifically to seek for clarification on labor roles) and to fill data gaps for the cowpea living mulch modelling paper (Sub-activity GH1111-19). A study STEPRI conducted under Africa RISING in 2019 (Sub-activity GH411-19) additionally throws up questions in terms of how the technology could be better adapted to farmers’ conditions. The follow-up will also examine these questions. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 To validate data on gender issues surrounding the experimentation with and sustainability of the living mulch technology on the household level with a specific focus on labor roles. | | | | | | | | | | | | | | | |
| 2.2 To collect quantitative data on differential labor investments and benefits of the technology on household fields (often controlled by male heads) as opposed to individual fields (controlled by individual women) for the cowpea living mulch modelling paper. | | | | | | | | | | | | | | | |
| 2.3 To examine how the technology could be better adapted to the differential conditions of farmers who have experimented with it. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 What are the gendered household labor roles that shape the application of the cowpea living mulch technology? | | | | | | | | | | | | | | | |
| 3.2 How do gendered labor investments and benefits differ on household fields as opposed to individual fields with regard to the cowpea living mulch technology? | | | | | | | | | | | | | | | |
| 3.3 What are the adaptations needed to facilitate the adoption of the cowpea living mulch technology? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| A survey will be conducted with farmers who were involved in the bio-physical trials. Key informant interviews will be held with regional level project implementers of the intervention. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | | | Responsibility |
| 5.1 Quantitative data collected in 2019 has been submitted for Dataverse upload. New data will be uploaded | | | | | | | | | | | | | | | IITA |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | End date | | | |
| 6.1 Processed data | | | | | | | Transcriptions and Excel files | | | | | June 2021 | | | |
|  | | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators (Assessed in 2019)** | | | | | | | | | | | | | | | |
| **Domain** | **Indicators** | | | | **Metric & Scale** | | | **Approach used in data collection** | | | **Before intervention** | | **After intervention** | | |
| 7.1 Productivity |  | | | |  | | |  | | |  | |  | | |
| 7.2 Environmental |  | | | |  | | |  | | |  | |  | | |
| 7.3 Economic |  | | | |  | | |  | | |  | |  | | |
| 7.4 Social | Labor roles  Drudgery scores  Income from sale  Productivity | | | | Household | | | * Survey * KII | | | N/A | | N/A | | |
| 7.5 Human |  | | | |  | | |  | | |  | |  | | |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| The findings of the follow-up will complement the 2019 study to inform discussions and decisions on gender-responsive strategies and practices to be chosen for dissemination. The results of these processes will be communicated to development partners for scaling. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| Linked to Cowpea living mulch effect on weed control, soil properties and maize yield completed in 2019 season.  The study is also linked to Sub-activity GH411-19: Simulation and other socio-economic analyses of selected SI technologies/practices for different farmer contexts for better understanding of the adoption potential of proven technologies and opportunities for scaling up (Sub-activity GH411-19). | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | |
| * Technical report for Cowpea living-mulch effects on maize grain yield, vegetation cover and soil moisture dynamics paper. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The cowpea living mulch intervention addresses food insecurity, natural resource management, and climate change adaptation. This sub-activity will complement the biophysical research by informing policy makers about gender issues surrounding adoption of the intervention. | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The study mainly targets smallholder farmers in Africa RISING intervention areas and extension officers. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | |
| **Budget Line** | **IITA** | | | |  | | |  | | |  | |  | | |
| Personnel | 3,700.00 | | | |  | | |  | | |  | |  | | |
| Services | 500.00 | | | |  | | |  | | |  | |  | | |
| Supplies | 246.67 | | | |  | | |  | | |  | |  | | |
| Capital |  | | | |  | | |  | | |  | |  | | |
| Travel | 796.67 | | | |  | | |  | | |  | |  | | |
| Overhead |  | | | |  | | |  | | |  | |  | | |
| **Total** | 5,243.33 | | | |  | | |  | | |  | |  | | |
|  | | | | | | | | | | | | | | | |

13. Gantt Chart

|  |  |
| --- | --- |
| **Year/ Month** | **2020-21** |
| **Oct 2020** | **Nov 2020** | **Dec 2020** | **Jan 2021** | **Feb 2021** | **Mar 2021** | **Apr**  **2021** | **May**  **2021** | **Jun 2021** |
| Tool development |  |  |  |  |  |  |  |  |  |
| Training of enumerators |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |
| Data processing and analysis |  |  |  |  |  |  |  |  |  |
| M&E for verification |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1112-20** | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | |
| a. Output 1.1 | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | |
| b. Activity 1.1.1 | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production | | | | | | | | | |
| c. Sub-activity GH1112-20 | | | Optimizing on-farm nitrogen (N) use efficiency under rainfed condition in maize-based cropping system | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | | | | Institution | | | Role | | | | |
| Abdul Rahman Nurudeen | | | | | IITA | | | Leader: Cereal agronomy and plant nutrition | | | | |
| Bekele Kotu | | | | | IITA | | | Economic analysis | | | | |
| Gundula Fischer/Kipo Jimah | | | | | IITA | | | Gender studies | | | | |
| Francis Muthoni | | | | | IITA | | | GIS input | | | | |
| George Mahama | | | | | SARI | | | Climate change specialist | | | | |
| Benedict Boyubie | | | | | IITA | | | Uploading of data onto PMMT and Dataverse | | | | |
|  | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | |
| Name | | | | Institute | | | | | Degree | Start | End | |
|  | | | | | | | | | | | | |
| f. Location(s) | Northern (Tingoli, Cheyohi no. 2, Doku, Tibali), Upper East (Samboligo, Nyangua, Gia, Bonia), Upper West (Zanko, Guo, Goli, Goriyiri) regions | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | June 2019 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | December 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| Maize is a heavy feeder of plant nutrients, especially nitrogen (N). Grain yields on farmers’ fields are low due to declining soil fertility. Application of inorganic fertilizer is responsible for large per capita food production in most parts of the world ([[1]](#footnote-1)Sanchez *et al*., 1997 & [[2]](#footnote-2)World Bank, 2017). The Government of Ghana’s flagship program on Agriculture (Planting for food and jobs) is promoting a new fertilizer mixture (15-20-20 kg/ha NPK + S + MgO + Zn) for cereals (maize, rice, and sorghum) for the 2019 cropping season. However, there is limited evidence on the quality and efficacy of this new fertilizer mixture compared to the best compound fertilizer in the market (YARA Actyva; 23-10-5 NPK + S + MgO + Zn). Following up on initial field activities conducted in 2019, this study will again determine the effect of the fertilizer type and management practices on maize growth, yield and N use efficiency under on-farm conditions. This study builds on the results from Africa RISING experiments of N fertilizer rates and variety effect on maize grain yield in northern Ghana (Africa RISING technical report March 2015 and 2016) to apply N fertilizer at 90 kg/ha. The results from this new study would provide empirical evidence to inform policymakers on the effectiveness of the proposed new fertilizer mixture.  This study was started last year (2019) and will need additional year’s data in order to make meaningful agronomic conclusions from the data. Furthermore, considering the application of the Sustainable Intensification Assessment Framework (SIAF) which has 5 (Productivity, Economic, Environment, Human and Social) domains, data were collected on productivity, environment and human domains leaving the economic and social domains during the first year of study. Therefore, repeating the study for the second year also gives us the opportunity to collect data from the sustainable intensification domains which were not captured during the first year of the study.  For the social domain, a gender study will focus on men’s and women’s preferences for fertilizer type (“blend” versus “compound”) and the mode and frequency of fertilizer application: 1. Application at planting only, 2. Application two weeks after planting only and 3. Application at planting and two weeks after planting. A short survey will investigate farmers’ drudgery perceptions (and other reasons for preferring one mode or frequency over the other) and will be combined with FGDs. It will also be considered whether farmers apply fertilizer on household fields (often under the control of the household head) or on individual fields (under individual control). The study will be integrated into a broader gendered analysis of the maize value chain. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 Determine the effect of fertilizer type, mode and frequency of its application on growth and yield of maize | | | | | | | | | | | | |
| 2.2 Evaluate gender preferences for fertilizer type, mode and frequency of its application practices | | | | | | | | | | | | |
| 2.3 Assess the impact of the overall technology package on household livelihoods and resilience | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 How does fertilizer type, mode and frequency of its application affect maize growth, yield and N use efficiency? | | | | | | | | | | | | |
| 3.2 What are the gender preferences for fertilizer type, mode and frequency of its application practices? | | | | | | | | | | | | |
| 3.3 What is the impact of having closed-loop resource flows when manure from fed animals is returned to the plots, are there any associated tradeoffs? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| The effect of 14 treatments of fertilizer type, time of fertilizer application and frequency of fertilizer applications: Control, New blend (NB) at planting and 5WAP, NB at 2WAP and 5WAP, NB at planting, 2WAP and 5WAP, Compound (CP) at planting and 5WAP, CP at 2WAP and 5WAP, CP at planting, 2WAP and 5WAP, Organic fertilizer, Organic fertilizer + NB at planting and 5WAP, Organic fertilizer + NB at 2WAP and 5WAP, Organic fertilizer + NB at planting, 2WAP and 5WAP, Organic fertilizer + CP at planting and 5WAP, Organic fertilizer + CP at 2WAP and 5WAP and Organic fertilizer + CP at planting, 2WAP and 5WAP) on maize growth, yield and N use efficiency would be determine using strip plot design in community-based technology parks and selected farmers’ fields. Composite soil samples will be taken from the experimental plots before and after harvest to analyze for nutrient content. In addition, greenhouse gas emission (carbon dioxide and nitrous oxide) from the above treatments will also be monitored using the static chamber technique ([[3]](#footnote-3)Clayton *et al*., 1994). A gender participatory evaluation will be conducted during field days to evaluate male and female preferences. The results of the agronomic study will be used in comparison with the soil nutrients maps developed by IFDC to refine and validate findings from the fieldwork. In collaboration with a GIS analyst and guidance from IFDC mapped data, we shall then extrapolate technology domains within the study areas and beyond. The gender study will rely on a short survey for drudgery scores and on a limited number of gender-separate focus group discussion. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | Responsibility/ Institute | | |
| 5.1 Maize grain yield and N use efficiency | | | | | | | | | | Nurudeen Abdul Rahman/ IITA | | |
| 5.2 Net income and return to labor | | | | | | | | | | Bekele Kotu/ IITA | | |
| 5.3 Soil quality | | | | | | | | | | Nurudeen Abdul Rahman/ IITA | | |
| 5.4 Greenhouse gas (GHG) emission | | | | | | | | | | George Mahama/ SARI | | |
| 5.5 Farmer preference for technology | | | | | | | | | | Nurudeen Abdul Rahman/ IITA | | |
| 5.6 Gendered rating of labor/drudgery | | | | | | | | | | Gundula Fischer & Kipo Jimah/ IITA | | |
| 5.7 Uploading of data onto Dataverse | | | | | | | | | | Benedict Boyubie/ IITA | | |
|  | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | End date | | |
| 6.1 Data on agronomic and gender preference for technology | | | | | | | Project semi-annual report | | | Mar. 2020 | | |
| 6.2 Database on Optimizing on-farm N fertilizer use efficiency | | | | | | | Dataverse | | | Dec. 2020 | | |
| 6.3 Published paper: Optimizing on-farm N fertilizer use efficiency under rainfed condition | | | | | | | Agronomy Journal | | | Dec. 2021 | | |
| 6.4 Infographic brochure with guidelines and benefits associated with crop-livestock interactions for resilience and livelihoods | | | | | | | Brochure distribution list and CG space | | | Nov. 2020 | | |
|  | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | |
| **Domain** | | **Indicators** | | | | **Metric & Scale** | | | **Approach used in data collection** | **Before intervention** | | **After intervention** |
| 7.1 Productivity | | Crop productivity  Crop biomass productivity  Input use efficiency | | | | Grain and stover yields (kg/ha) at plot/ field level,  N use efficiency (g/kg N) at plot / field level | | | Field measurements of yield | Conventional or control practice grain and stover yields and N use efficiency | | 25% increase in grain and stover yields and N use efficiency |
| 7.2 Environmental | | Soil chemical quality  GHG emission | | | | Soil nutrient partial balance at plot (kg/ha)/ field level  CO2 and N2O emitted (mg/m2/h) at plot/ field level | | | Soil and plant tests | Conventional or control practice soil partial balance and CO2 and N2O | | <5% increase in soil partial balance, <5% decrease in CO2 and N2O emissions |
| 7.3 Economic | | Profitability  Labor requirement  Return to labor | | | | Net income at plot (GHS/ha)/ field level  Farmer rating of labor at plot/ field level  Return to labor (GHS/person day) at plot/ field level | | | Survey, productivity measurement and farmer evaluation | Conventional or control practice net income and return to labor | | 15% increase in net income and return to labor |
| 7.4 Social | | Gender equity | | | | Technology rating by gender (no. of farmers per technology) at plot/ field level | | | Participatory evaluation | Preference for conventional or control practice | | 20% increase in farmer preference for new technology by gender |
| 7.5 Human | | Food security  Capacity to experiment | | | | Calorie production at plot (kcl/ha)/ field level  % of farmers experimenting at household level | | | Look up table, productivity measurements and focus group | Conventional or control practice calorie production | | 25% increase in the calorie production and number of farmers experiment new technology |
| 8. How will scaling be achieved? | | | | | | | | | | | | |
| Scaling will be achieved through strategic partnerships with private partners such as WorldCover. Knowledge transfer and scaling strategies will include: the establishment of research-for-development plots to demonstrate technologies; participatory and joint learning approaches for technology testing, e.g., Community-based Technology Parks; development of media materials (posters, leaflets, films) for extension staff, farmers, etc.; exchange visits for farmers and researchers; training of trainers and hands-on training for farmers. | | | | | | | | | | | | |

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| 9. How are the activities in this protocol linked to those of others? | | |
| This sub-activity is linked with maize leaf stripping feeding trial and scaling of validated agronomic technologies with multi-stakeholder partners (GH4111-20) | | |
|  | | |
| 10. Custom indicators | | |
| * Project semi-annual report * Agronomic database * Journal publication | | |
|  | | |
| 11. Impact-based summary matrix | | |
| 11.1 What is the development challenge you are addressing?  Food insecurity, natural resource management, and climate change adaptation.  This sub-activity will address the following major development challenges. (I) food insecurity, (ii) the sub-activity will also reduce the negative effects of climate change and variability on crop productivity, (iii) it will also increase farmers adaptive capacity to climate change and contributes to increasing crop productivity in the area and (iv) increased productivity can also contribute to a profitable crop enterprise thereby improving household income. | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers, extension agents, and policymakers | | |
|  | | |
| 12. Budget for sub activities GH1111-20 | | |
| **Budget line item** | **IITA** | **SARI** |
| Personnel | 147000 | 2,000 |
| Services | 22000 | 3,000 |
| Supplies | 26000 | 0 |
| Capital | 0 | 0 |
| Travel | 4000 | 2,000 |
| Overhead | 0 | 1050 |
| **Total** | **199,0001** | **8,050** |
| **Grand Total** | **207,050** | |
| 1Includes costs of running and maintaining 3 vehicles and 7 motorbikes for the 25 intervention communities in the Northern (Tamale), Upper West (Wa), Upper East (Navrongo) regions, staff cost for postdoc, technicians and drivers, $5000 for soil and fertilizer chemical analysis at SRI.  Included 2,000 USD for gendered study on services budget | | |

13. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/Month** | **2020** | | | | | | | **2021** | | | | | | | | | | | |
| **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| **GH1111-20** | | | | | | | | | | | | | | | | | | | |
| Farmer sensitization |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Training of Field Technicians |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Field establishment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Field monitoring |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Community field days |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Harvesting |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data processing and analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Semi-annual report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Journal publication |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1113-20** | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | |
| 1. Output 1.1 | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, and vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | |
| b. Activity 1.1.1 | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production | | | | | | | | | | | |
| c. Sub-activity: GH1113-20 | | | Assessing the potential for a combination of local Napier fodder species and pigeon peas for improved soil health, ruminant productivity and market potential of both Napier and Pigeon pea fodder in the Guinea savannah zone and Investigating opportunities and constraints for fodder cultivation and trade (Napier and Pigeon pea), specifically women’s and youth market participation in this part of the livestock value chain. | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | | | | | |
| Terry Ansah | | | UDS | | | | Lead in the implementation of the fodder cultivation, data collection and feeding trial and feed quality assessment. | | | | | | | |
| Abdul Rahman Nurudeen | | | IITA | | | | Input on agronomic aspects of pigeon pea intercrop with pastures | | | | | | | |
| Fred Kizito | | | IITA | | | | Contributing ta analysis and lead in incorporating soil health attributes: soil and water conservation in the fodder cultivation | | | | | | | |
| Gundula Fischer/Kipo Jimah | | | IITA | | | | Support on gendered value chain analysis | | | | | | | |
| Benedict Ebito Boyubie | | | IITA | | | | Developing data collection tools, training he research team on Feed the Future indicators and support in data collection to track output level and Feed the future indicators  Ensuring data upload on Dataverse | | | | | | | |
| \*Bekele Kotu | | | IITA | | | | Socio-economic studies and cost-benefit analysis of pasture cultivation | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | Institute | | | Degree | | | | Start | | | End | |
| 1. Emmanuel Afrifa | | | UDS | | | MPhil | | | | 2020 | | | 2021 | |
|  | | | | | | | | | | | | | | |
| f. Location(s) | | | Northern Region (Savelugu District-Duko Technology Park) | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | | | August 2020 | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | | | September 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| This sub-activity was initially conducted in the year 2019/2020 and is now being conducted for the second season to verify findings from the previous year. In addition, a new related sub-activity linking to Outcome 3 on the marketing potential of the fodder from Napier and Pigeon pea in the Guinea savannah zone has been added. Natural pasture or rangeland remains the single most important source of forage for ruminants in most developing countries. Rangeland occupies about 54% of the terrestrial ecosystems and sustains approximately 30% of the world’s population (Reynolds et al. 2007; Estell et al. 2012). Increase in urbanization and competition for land are major threats to the availability of rangelands for livestock production (Oba 2013). In addition, the adoption of policies that favor crop production over the maintenance of pasture is also gradually reducing the area of land for grazing livestock. It has been estimated that almost 75% of rangelands have been lost to desertification and soil degradation (UNCCD 2009). It has been observed that in the wet season, access to fodder from rangeland is often limited due to the extensive cultivation of food crops. This has the tendency to affect the productivity farm animals which will ultimately affect household food security and income.  The introduction of farmers to the cultivation of fodder in the rainy season could augment the supply of biomass and nutrients from crop residues and would also reduce the distance often covered by animals to access fodder from natural sources. The number of children who are often involved in sending animals out for grazing at the expense of their education will be reduced. Conflicts associated with crop destruction by farm animals in the rainy season will be minimized. Milk yield from lactating cows in Ghana is relatively lower and this has been attributed to the low potential of the breeds of cattle in Ghana and most importantly the problem of inadequate nutrition (Digestible protein and metabolizable energy). Inadequate nutrition could also account for a shorter length of lactation in animals leading to a reduced milk yield. The consumption of milk, especially among children from cows is very common in most households that keep cows. It has the potential to reduce child malnutrition. Other small ruminant species also play a very important role in ensuring household food security and income.  The survival and productivity of different grass species could be influenced by origin, including temperature, light intensity, total rainfall, soil type, fertilization level, and by stage of maturity. This makes the selection of a suitable fodder species for ruminant livestock production very critical.  Napier grass (*Pennisetum purpureum*), is a high yielding perennial grass native to most African countries including Ghana. Yield is even much higher in areas with regular supply of water. Annual yields of 85.4 tonnes of dry matter (DM) per ha without fertilizer and up to 130 tonnes DM per ha with 1,320 kg/ha of nitrogen (N) fertilizer have been recorded (Boonman 1993). The yield of napier grass can be affected by geographical location, which is largely influenced by temperature, rainfall and N supply (Minson 1990). Ansah et al. (2010) reported yields ranging from 4,863 kg/ha to 44,994 kg/ha of DM in the humid zone of Ghana. In Duko, an Africa RISING community in the dry savanna zone of Ghana, Cudjoe et al. (2017) reported biomass yields in the range of 1,354 kg DM/ha to 3,339 kg DM/ha with the local variety possessing superior qualities. Napier grass has also been found to be the most effective barrier grass in controlling soil erosion in maize farms in Kenya (Mutegi et al., 2008). In addition, the combination of Napier grass with legumes has been reported to increase water stored in the crop root zone (Kizito et al, 2016). We intend to use a dual purpose legume, pigeon pea (*Cajanus* c*ajan*) which serves as food for farming families and feed for livestock. Although agronomic trials of Napier have been conducted in Ghana, very little has been done on the effect of intercropping *Cajanus cajan* with Napier in the dry savanna zone of Ghana. The rationale for location of this trial in Duko is that there is an irrigation facility that will permit for testing of performance of irrigated fodder out of season. This study will help provide better insights on the merits around the association of Napier grass and pigeon pea. The addition of pigeon pea could potentially help respond to questions that link Africa RISING work to the Innovation Lab for Legume Systems Research.  The bio-physical investigation will be integrated with a broader gender analysis of the livestock value chain. Feed is the most important input into small-scale livestock production. It relates (among others) to labor roles and access to water and land at the household level. Where feed is cultivated (as in the above outlined biophysical trials) gendered patterns of labor and resource allocation shape men’s and women’s opportunities for and benefits from participation in the activity. This again may influence the application and uptake of the technology and potential value chain participation. Gendered norms and patterns also relate to the organization of fodder and small ruminant trade, more specifically to the presence and opportunities of men and women at various nodes. Focus group discussions and a concomitant survey with male and female livestock farmers, traders and other value chain actors in relation to this and other activities in the Ghana work plan (GH1121-20 and GH1123-20) will carve out women’s and youth potential to engage in the livestock value chain. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 Determine the growth characteristics (including recommended coppicing regimes), nutrient composition and in vitro digestibility of the local Napier grass intercropped with or without *Cajanus cajan.* | | | | | | | | | | | | | | |
| 2.2 Determine the effect of intercropping on the grain yield, fodder yield and quality of *Cajanus cajan* | | | | | | | | | | | | | | |
| 2.3 Determine the effect of the sole Napier or intercrop on soil health specifically around soil and water conservation (soil losses and soil moisture) | | | | | | | | | | | | | | |
| 2.4. Assess the marketing potential of fodder from Napier and Pigeon pea among forage traders and barriers to adoption among smallholder farmers (including gender analysis). | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 Can a combination of Napier grass and Pigeon pea enhance fodder yield and quality as well as grain yield? | | | | | | | | | | | | | | |
| 3.2 What is the recommended coppicing regime for Napier and Pigeon pea in order to have optimal results? | | | | | | | | | | | | | | |
| 3.3 Is there an effect of intercropping Napier grass with pigeon pea on the grain yield, fodder yield and quality of *Cajanus cajan*? | | | | | | | | | | | | | | |
| 3.4 What are the effects of sole Napier grass or the combination of Napier grass and *Pigeon pea* on soil health? | | | | | | | | | | | | | | |
| 3.5 What is the marketing potential of fodder from Napier and *Cajanus cajan* among forage male and female traders and smallholder farmers? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| 4.1 Data will be collected from both survey and experimental plots. Six forage traders and ten small ruminants will be interviewed on the marketability of fodder from Napier grass and Cajanus cajan. The nine crop/livestock farmers involved in the cultivation will also be interviewed on the barriers to adaptation of the forage cultivation. The experimental plots for the cultivation of Napier and Pigeon pea will be laid in a completely randomized block design. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Study area**  The study will continue being conducted at the Africa RISING Technology park in Duko. Similar to the previous methodology, Nine small ruminant farmers will be selected with a new aspect of adding **six forage traders who** will be selected to participate in this trial. The rationale for location of this trial in Duko is that there is an irrigation facility that will permit for testing of performance of irrigated fodder out of season.  **Cultivation of Napier grass and feeding trial:**  The small ruminant farmers (9) will be randomly assigned to 36 plots each measuring 0.25 acres. An area of 0.25-acre will be cultivated at a distance of 0.5 by 0.5m between plants. The Pigeon pea will be introduced after every row of Napier grass at a planting distance of 1 by 1m.  The Napier grass will be allowed 8 weeks to establish during which data on plant height, tiller number, stem diameter will be taken. The grass will be harvested 8 weeks after planting and biomass yield determined. Subsequent harvests will be done at 4 weeks intervals during the rainy season.  Two weeks after planting the Napier, Pigeon pea will be introduced into the field. Data will be collected on germination, date to flowering, plant height and grain yield. Fodder yield from the Pigeon pea will be estimated.  The nutrient composition (DM, CP, NDF, ADF, Ash) and in vitro digestibility of the harvest fodder in both Napier and Pigeon pea will be determined.  **Effect of sole Napier or intercrop on the soil:**  Prior to the planting of the forages, some soil physio-chemical properties in the upper 0-15 cm of the soil at the will be measured. An access tube will be installed in each plot to monitor soil moisture variations while runoff detectors will be installed in block to monitor soil losses. Soil accumulation, soil losses, soil moisture, percentage soil cover will be measured on all plots.  M**arketing potential of Napier grass and *Cajanus cajan* fodder among fodder traders in the Northern Region:**  Two major actors in the trade of fodder, small ruminant traders and fodder traders will be interviewed on the marketing potential of Pigeon pea and Napier grass fodder. A total of 6 forage traders and 10 small ruminant traders in the Tamale Metropolis will be interviewed using a structured questionnaire.  **Adoption of Pigeon pea and Napier grass cultivation among crop/livestock farmers**  A focus group discussion will be organized for farmers involved in the cultivation of the forage to assess the barriers to the adoption of the technology.  ***Data analysis:***  Napier grass and *Cajanus cajan*  The data from agronomic trial, grain yield and fodder quality will be analyzed by ANOVA. The performance of sole Napier and sole Pigeon pea will be compared to the intercrop. The grain yield from the pruned and unpruned Pigeon pea will be compared. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on dataverse | | | | | | | | Responsibility/ Institute | | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | |  | | | | | | |
| 5.1 Data on fodder yield, fodder quality and animal performance | | | | | | | | Terry Ansah/UDS | | | | | | |
| 5.2 Soil health (soil losses, soil moisture) | | | | | | | | Fred Kizito (IITA) | | | | | | |
| 5.3 Perception of fodder traders on market potential of fodder | | | | | | | | Bekele Kotu/IITA | | | | | | |
| 5.4. Gender analysis of the livestock value chain (focus on feed cultivation and trade) | | | | | | | | Gundula Fischer and Kipo Jimah/IITA | | | | | | |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | | Means of verification | | | | | Date |
| 6.1 Data on agronomic and gender preference for technology | | | | | | | | |  | | | | | Dec 2020 |
| 6.2 Cost-benefit and labor input data | | | | | | | | |  | | | | | Feb 2021 |
| 6.3 Data on fodder yield in relation to rumnant productivity | | | | | | | | |  | | | | | Mar 2021 |
| 6.4. Analysis of interviews of forage traders | | | | | | | | | Semi-annual report submitted to IITA | | | | | Mar 2021 |
| 6.5. Soil health data in relation to Napier and Pigeon pea intercrops | | | | | | | | | Semi-annual report submitted to IITA | | | | | Mar 2021 |
| 6.6. Presentation of results at Ghana Animal Science Association conference | | | | | | | | | Book of proceedings | | | | | Aug 2021 |
|  | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | |
| **Domain** | **Indicators** | | **Metric & Scale** | | **Approach for data collection** | | | | | **Before intervention** | | **After intervention** | | |
| 7.1 Productivity | Crop productivity  Crop biomass productivity (Napier and Pigeon Pea) | | Grain yield at plot/field level/season  Forage yield at plot/field level/season  (Kg/ha/season) | | Experimental plots, laboratory analysis | | | | |  | |  | | |
| 7.2 Environmental | Erosion | | -Soil loss (tons/ha/season at plot level  -Rating of erosion | | -Field measurements  -Participatory exercise | | | | |  | |  | | |
| 7.3 Economic | Market Participation (potential) of fodder | | Acceptability and barriers to adoption at community level | | Interview/Surveys or participatory exercises | | | | |  | |  | | |
| 7.4 Social | Gender market participation | | Participation in a collective action group | | Interviews/surveys | | | | |  | |  | | |
| 7.5 Human | Grain production | | Grain yield/plot | | Experimental plots | | | | |  | |  | | |
|  | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | |
| Scaling will be through MoFA and NGOs working in the livestock sector as well as linking to the Research Extension Linkage Committees (RELCs) for the Savelugu District. In addition, since the trial will be conducted in a Technology Park, we anticipate that visitors coming to this park and the participatory and joint learning approaches from the technology testing will allow for scaling | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 9 How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | |
| This activity linked with soil and water conservation (GH1111- 20 and GH1212- 20) in relation to livestock feeding activities (as elaborated in the partnerships profile in Section d. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 10. Custom indic ators | | | | | | | | | | | | | | |
| - Recommendation Booklet: In the context of forage for food, feed and land and water management strategies | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing? | | | | | | | | | | | | | | |
| This sub-activity addresses improved livestock productivity thereby enhancing household food security and nutrition and income. | | | | | | | | | | | | | | |
| 11.2. Who is your target audience? e.g. extension agents, farmers, or policy makers: | | | | | | | | | | | | | | |
| Smallholder crop and livestock farmers, forage traders, agricultural extension agents | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **12. Budget** | | | | | | | | | | | | | | |
| **Budget (USD)** | | **UDS-FA2** | | **IITA 1 (Environment)** | | | | | | | **IITA 2 (Socio-economic for Bekele and Gundula)** | | | |
| Budget Line | |  | |  | | | | | | |  | | | |  |  |  |
| Personnel | | 7,000 | | 0 | | | | | | |  | | | |
| Services | | 3000 | | 2,000 | | | | | | |  | | | |
| Supplies | | 3,000 | | 2,000 | | | | | | | 10,000 | | | |
| Capital | | 0 | | 2,000 | | | | | | |  | | | |
| Travel | | 4,000 | | 1,000 | | | | | | |  | | | |
| Overhead (15%) | | 2,550 | | 0 | | | | | | |
| **Total** | | **19, 550** | | **7,000** | | | | | | | **10,000** | | | |

13. Gantt chart

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2020** | | | | **2021** | | | |
| **Month** | **Aug** | **Sep** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Field establishment |  |  |  |  |  |  |  |  |
| Monitoring moisture |  |  |  |  |  |  |  |  |
| Monitoring of forage and Pigeon pea growth trends |  |  |  |  |  |  |  |  |
| Soil health (soil moisture trends) |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |
| Interview of forage traders and farmers |  |  |  |  |  |  |  |  |
| M&E for verification |  |  |  |  |  |  |  |  |
| Journal article preparation  (including last years data) |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1115-20** | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | |
| a. Output 1.1 | | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | |
| b. Activity 1.1.1 | | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production | | | | | | | | |
| c. Sub-activity GH1115-20 | | | | Identification of major pests and diseases and management of vegetable crop species to preserve post-harvest product quality for Northern Ghana in the dry season | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | | | |
| Jean Baptiste Tignegre | | | WorldVeg | | | | Activities coordination | | | | | |
| Wubetu Legesse | | | WorldVeg | | | | Sub-activity leader: Advice and collect data on pests and diseases: design protocols; data analysis and contribute to drafting the final report | | | | | |
| Fred Kizito | | | IITA | | | | Hosts & advises WorldVeg team in Ghana | | | | | |
| 1. Nurudeen | | | IITA | | | | Supervise fieldwork data collection & soil sample analysis | | | | | |
| Linda Dari | | | WorldVeg | | | | Implement postharvest and processing training, quality analysis | | | | | |
| Edoh Ognakossan Kukom | | | Consultant | | | | Provides overall technical support for sub-activity | | | | | |
| Paul A. Zaato | | | WorldVeg | | | | Supervise fieldwork and collect data in Ghana | | | | | |
| Desire Dikson | | | WorldVeg | | | | Collect data in Ghana | | | | | |
| Victor A. Sefa | | | WorldVeg , | | | | WorldVeg Regional Director, WCA-Coastal Humid Regions; Worldveg representative for AR project Mali | | | | | |
| Elijah Bobby | | | MoFA, Department of Agriculture, Kasena Nakana East, Navrongo | | | | Extension agent: mobilization, supervision | | | | | |
| Benedict Ebito Boyubie | | | IITA | | | | Develop data collection tools, train the research team on Feed the Future indicators and support in data collection to track output level and Feed the future indicators  Ensure data upload on Dataverse | | | | | |
|  | | | | | | | | | | | | |
| f. Location(s) | | Nyangua and Gia (UER) and Duko (NR) | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | | Oct 2019 (variety diseases, pests characterization) | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | | Sept. 2020 (variety agronomic performance); Sept. 2021 (variety diseases, pests characterization) | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| Previous work related to farmer’s participatory appraisal conducted in Northern Ghana showed that the key constraints for vegetable production are limited access to improved vegetable species and varieties and vulnerability of the existing varieties to diseases and pests. Diseases such as Bacteria wilt and pests such as white flies and *Tuta* *absoluta* are amongst the major production constraints in Ghana. *Stemphylum* disease was reported in Ghana on onion. These constraints are aggravated by degraded soils with low water retention capacity. Very low amounts of vegetables produced locally are consumed by households which maintain relatively high malnutrition rates for infants and breast-feeding women.  The proposed activities aim at enhancing vegetable production by increasing the introduction and adoption of improved varieties under integrated pest and disease management. It is expected that vegetable productivity will increase by introducing integrated pest and disease management to control for Aphids, thrips, white flies’ resistant varieties, Bacteria wilt, virus).  *(This sub-activity is over for variety tests in last year’s workplan but IPM data and postharvest data are needed and an additional year in 2021 for two years data completion in order to publish a manuscript)*  This -sub-activity integrates production through disease and post-harvest management  Farmers in Northern Ghana have been facing increasing diseases and pest damages on vegetables (tomato wilting, virus on pepper, white flies, *Tuta absoluta*, etc.).  Six vegetable hubs are available in the Northern Region of Ghana and are equipped with irrigation facilities to host replicated vegetable trials on tomato, pepper and onion.  A nursery of 26 new tomato and 14 new pepper varieties will be established in the lead hubs to enable preliminary participatory selection by farmers with regards to diseases and yield performance, market acceptance, food and feed suitability (fruit size, color, taste, shelf life). Data will be collected on leaf and fresh fruits yield, plant diseases. Field observation on farmers’ fields and experimental plots will be conducted during the growing season and preliminary identification of diseases will be undertaken based on the symptoms on the plants. In addition, samples will be collected and identification and characterization of diseases will be done in the laboratory. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 Identify/characterize diseases and pests prevailing on tomato pepper in UER and NR | | | | | | | | | | | | |
| 2.2 Evaluate diseases and pests damages on vegetables | | | | | | | | | | | | |
| 2.3 Improve farmers’ capacity on good agricultural practices through the use of effective disease control measures that preserve post-harvest product quality | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 What are the most prevailing diseases on vegetables and how can these be controlled effectively during the dry season? | | | | | | | | | | | | |
| 3.2 What strategies can we use to promote information and knowledge exchange on good agricultural practices to reduce diseases & pests damages and improve product quality? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| Demonstration on integrated pest management will be carried out in the Lead hubs to reduce crop losses, avail healthy products and improve income. Farmers will implement vegetable disease and pest assessment of their preferred vegetable varieties and species. In each of the six target community hubs, new vegetable varieties and local varieties will be compared diseases and pest resistances and postharvest product quality losses (validated or improved varieties vs. adapted local variety). | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data to be collected and uploaded  Are the data collected part of a multi-year experiment? Yes for varietal disease screening and identification data | | | | | | | | | | | | Responsibility |
| 5.1 Diseases and pests sampling and characterization | | | | | | | | | | | | WorldVeg |
| 5.2 Disease & pest incidence (fungi, bacteria, virus, white flies, thrips, aphids, mites); new resistance sources | | | | | | | | | | | | WorldVeg |
| 5.3 Temperature and relative humidity inside ZECC or in ambient conditions | | | | | | | | | | | | WorldVeg |
|  | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | End date | |
| 6.2 Project reports on vegetable yields, disease & pests performances under field and storage | | | | | | Database uploaded on Dataverse | | | | | Jul. 2021 | |
| Project reports on vegetable diseases and pests prevailing in Northern Ghana | | | | | | Data uploaded in Dataverse | | | | | Jul. 2021 | |
| 6.3 Reports on farmers training and trial establishment | | | | | | Report on training with number of participants segregated into sex and age | | | | | May 2021 | |
| 6.4 Two technical leaflets and policy briefs produced | | | | | | Report with number of leaflets distributed | | | | | July 2021 | |
| 6.5 One journal article submitted/published | | | | | | Manuscript or published article | | | | | Sept 2021 | |
|  | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | |
| **Domain** | **Indicators** | | | | **Metric & Scale** | | | **Approach for data collection** | **Before intervention** | **After intervention** | | |
| 7.1 Productivity | Crop productivity | | | | Fruit yield loss (kg/ha) at the field/ plot level; fodder yield (kg/ha) | | | Fisher blocks field experimental design | Check or control yield | 20% Fruit yield increase as compared to check or control yield | | |
| 7.2 Environmental | Prevailing diseases | | | | Disease score at plot level | | | Fisher block design; laboratory analysis | Little knowledge on prevailing diseases & pests biotypes on vegetables; | -Number of vegetable diseases & pests biotypes identified;  -incidence of pest & diseases evaluated; | | |
| 7.3 Social | Report on gender preference for varieties | | | | Field level (variety rank/sex; rank/age) | | | Focus group discussion; Questionnaire; | The reference is check variety or control treatment (local variety; | Traits of interest by sex, age known; | | |
| 7.4 Human | Report on food quality analysis & nutrients contents as affected by diseases & pests | | | | Weight loss (kg/ha) at farm & plot levels Quality parameters at plot level (color, total soluble solids, acidity, vitamin C) | | | Laboratory analysis of nutrient content & product quality | Effects of diseases & pests on fruits/bulb quality unknown | different amendment Effects of diseases & pests on fruits/bulb quality established | | |
|  | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | |
| UDS, Cathwel, Women farmers’ associations in UER, NR, NARES will be involved as s partners to implement the activities in 2020-2021. Knowledge transfer and scaling strategies will include the establishment of research-for-development plots to demonstrate technologies; participatory and joint learning approaches for variety selection in the community-based vegetable hubs as well as farm fields; development by WorldVeg of training of trainers and hands-on training for farmers. The technologies will be also exposed to seed enterprises and food processors during field and open days who will select the best technologies for wider dissemination. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| Activities have links with those on vegetable and livestock production, and nutrition | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | |
| * Six demonstrations/trials established * Two project reports produced * Two technical leaflets and policy briefs produced   One journal article submitted/published | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  (i) High pressure of diseases & pests no effective control methods and uses of prohibited pesticides (ii) high post-harvest losses by household farmers due to low access to affordable storage facilities, (iii) high rates of malnutrition prevailing for women and infants due to low consumption of vegetables. | | | | | | | | | | | | |
| 11.2 Who is your target audience? e.g. extension agents, farmers, or policymakers:  The targeted audience is farmers, extension agents, NGOs, farmers’ associations, local community leaders and policymakers. | | | | | | | | | | | | |

12. Budget: Please see sub-activity GH1116-20 (Budget for GH1115-20 embedded with GH1116-20)

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | **2021** | | | | | | | |
| **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Nursery establishment |  |  |  |  |  |  |  |  |  |  |  |  |
| Land preparation |  |  |  |  |  |  |  |  |  |  |  |  |
| First Meeting management committee |  |  |  |  |  |  |  |  |  |  |  |  |
| Planting and Transplanting  Training on GAPHP |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |  |  |  |
| Report submission & data upload in dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| Final report submission & data upload in dataverse |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| As with the above sub-activity UDS, Cathwel, women farmers’ associations in UER, NR, NARES will be involved as s partners to implement the activities in 2020-2021. Knowledge transfer and scaling strategies will include the establishment of research-for-development plots to demonstrate technologies; participatory and joint learning approaches for the selection of farmers’ preferred manure application rates in the community-based vegetable hubs as well as farm fields; development by WorldVeg of training of trainers and hands-on training for farmers. The technologies will be also exposed to seed enterprises and food processors during field and open days who will select the best technologies for wider dissemination. | | | |
|  | | | |
| 9. How are the activities in this protocol linked to those of others? | | | |
| Activities have links with those on vegetables GH1115-20 and nutrition GH2122-19 | | | |
|  | | | |
| 10. Custom indicators | | | |
| * Two demonstrations/trials established * Two project reports produced * Two technical leaflets and policy briefs produced * One journal article submitted/published | | | |
|  | | | |
| 11. Impact-based summary matrix | | | |
| 11.1 What is the development challenge you are addressing?  (i) degraded soils with very low nutrients in the lead hubs (ii) recommended rates of manure and mineral fertilizers are very expensive, and (iii) high post-harvest losses by household farmers due to low access to affordable storage facilities | | | |
| 11.2 Who is your target audience? e.g. extension agents, farmers, or policymakers:  The targeted audience is farmers, food processors, farmers’ associations, local community leaders, extension agents, NGOs and policymakers. | | | |
|  | | | |
| 12. Budget Line (xUSD) | IITA | UDS | WorldVeg |
| Personnel | 3,000 | 2,000 | 16,000 |
| Services | 4,000 | 3,000 | 18.500 |
| Supplies | 3,000 | 4,000 | 7,000 |
| Capital | 0,000 |  | 0,000 |
| Travel | 2,000 | 6,000 | 12.500 |
| Overhead |  |  | 11,900 |
| **Total** | 12,000 | 15,000 | 65,900 |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | **2021** | | | | | | | |
| **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Planting and Transplanting  Training on GAPHP |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |  |  |  |
| -Renovation of storage facilities & tests |  |  |  |  |  |  |  |  |  |  |  |  |
| -Report submission & data upload in dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| First harvest |  |  |  |  |  |  |  |  |  |  |  |  |
| Harvest |  |  |  |  |  |  |  |  |  |  |  |  |
| Participatory variety selection |  |  |  |  |  |  |  |  |  |  |  |  |
| Field day |  |  |  |  |  |  |  |  |  |  |  |  |
| Report submission & data upload in dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| Final report submission & data upload in dataverse |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1121-20** | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | Research products for more productive, intensive, diverse, profitable and resilient crop (cereals, legumes, and vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | | |
| b. Activity 1.1.2 | | | Test and disseminate a combination of improved breeds, housing, feeding, health and breeding practices to intensify rearing of livestock (sheep, goat, pig, and poultry) for meat, egg and milk production. | | | | | | | | | | | | |
| c. Sub-activity GH1121-20 | | | Evaluate efficient feed utilization through improved feed troughs | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | | | Role | | | | | | |
| Augustine Ayantunde | | | | | ILRI | | | | Coordination of sub-activity, data analysis and drafting of manuscript | | | | | | |
| Sadat Salifu | | | | | ARI | | | | Data collection on how time saved through improved feed troughs is spent, establishment of improved feed troughs at Technology Parks, assistance in data analysis and drafting of manuscript | | | | | | |
| Bekele Kotu | | | | | IITA | | | | Contribute to cost and benefit analysis of the feed troughs | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | Degree | | Start | End | | |
|  | | | |  | | | | | |  | |  |  | | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | Duko and Tibali (Northern Region), Gia (Upper East Region) | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | August 2018 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | March 2021 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| Data has been collected on the use of improved feed troughs for small ruminants in Duko and Tibali (Northern region), and in Gia (Upper East region) involving thirty farmers (10 farmers in each community) between August 2018 and March 2020. A technical report has been prepared from the preliminary results from data collected in the late dry season (March/April 2019), wet season (September/October 2019) and early dry season (February 2020). The results showed that the improved feed troughs reduced feed waste significantly in all the study communities. The percentages of waste in feeding the animals using the traditional feed troughs were 35%, 22% and 27% in Duko, Gia and Tibali, respectively in the late dry season compared to less than 1% with the improved feed troughs during the same season, which implies about 34%, 21% and 26% feed saved in Duko, Gia and Tibali, respectively. Similar trends were observed in the wet and early dry seasons. The time spent in feeding the animals was almost halved with the improved feed troughs in the three communities in the late dry season and early dry season. On the time spent feeding the animals, we would need to collect additional information on how the time saved through the improved feed troughs were spent by the participating farmers. The results from the study look promising and can be used to produce a good paper which is the focus of this sub-activity. To promote scaling of the improved feed troughs, two units each will be built at 8 Technology Parks in Northern, Upper East and Upper West regions. | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 The objective of this sub-activity is to produce a journal article on efficient feed utilization through improved feed troughs in Northern Ghana for publication in a journal. | | | | | | | | | | | | | | | |
| 2.2 To document how time saved through the use of improved feed troughs is spent by the participating farmers. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 Do seasons affect the quantity of feed that could be saved through improved feed troughs? | | | | | | | | | | | | | | | |
| 3.2 How was the time saved from using improved feed troughs spent by the participating farmers? | | | | | | | | | | | | | | | |
| 3.3 Who are the adopters of the improved feed troughs and what are the drivers of adoption? What are the constraints to the adoption by non-adopters? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| The data collected in the late dry season (March/April 2019), wet season (September/October 2019) and early dry season (February 2020) will be analyzed and a manuscript will be drafted based on the results from the data analysis. The manuscript will be submitted to Tropical Animal Health and Production. Additional data will be collected on the use of time saved from the improved feed troughs by the participating farmers. To enhance scaling of the improved feed troughs, 2 units each will be established in 8 Technology Parks in Northern, Upper East and Upper West regions. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | | | Responsibility |
| 5.1 Data on how time saved is spent by the participating farmers | | | | | | | | | | | | | | | ILRI |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | End date | | | |
| 6.1 Draft manuscript on efficient feed utilization through improved feed troughs for small ruminants in Northern Ghana | | | | | | | confirmation of submission by the journal | | | | | Oct 2020 | | | |
| 6.2 Published journal article on the effect of improved feed trough on feed utilization by small ruminants | | | | | | | Journal | | | | | March 2021 | | | |
| 6.3 Finalization of the West Africa Handbook in collaboration with the co-authors as a team | | | | | | | Handbook revisions | | | | | Oct 2020 | | | |
| 6.4 Establishment of improved feed troughs in the Technology Parks | | | | | | | Feed troughs establishments in Technology Parks documented in semi-annual reports | | | | | Nov 2020 | | | |
|  | | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | | |
| **Domain** | | **Indicators** | | | | **Metric & Scale** | | **Approach for data collection** | | | **Before intervention** | | | **After intervention** | |
| Not applicable for a draft manuscript | |  | | | |  | |  | | |  | | |  | |
| Productivity | |  | | | |  | |  | | |  | | |  | |
| Environment | |  | | | |  | |  | | |  | | |  | |
| Economic | |  | | | |  | |  | | |  | | |  | |
| Social | |  | | | |  | |  | | |  | | |  | |
| Human Can also be argued in an economic sense | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| Publication of the results from the testing and evaluation of the use of the improved feed troughs in a scientific journal will facilitate dissemination of the technology to a wide scientific community which can promote scaling. Also the establishment of the improved feed troughs in the Technology Parks will enhance scaling of the technology. Also, to facilitate adoption of improved feed troughs with local materials, the model has been | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |

|  |  |
| --- | --- |
|  | |
| This sub-activity is linked to activities on improved crop varieties as the improved feed troughs will be used to feed the crop residues to the animals. This is related to activity 1.1.1: Test and disseminate a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production. | |
| 10. Custom indicators | |
| * Submitted/published article | |
|  | |
| 11. Impact-based summary matrix | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed is improved food security for the smallholder crop and livestock farmers as improved feed troughs will enhance feed use efficiency thereby increasing livestock productivity and consequently food security of the farmers. Less feed waste can also contribute to a profitable livestock enterprise thereby improving household income. | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The smallholder crop and livestock farmers, extension agents and scientific community | |
|  | |
| 12.Budget (US$) |  |
| **Budget Line** | **ILRI** |
| Personnel | 28,510 |
| Services | 5,500 |
| Capital | 0 |
| Travel | 3,000 |
| Sub-grantee: Animal Research Institute (ARI) | 20,000 |
| Overhead (15%) | 8,927 |
| **Total** | **68,437** |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month/ Week** | **2020** | | | | | | **2021** | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** |
| Data collection on use of time saved from improved feed troughs |  |  |  |  |  |  |  |  |  |  |  |  |
| Drafting of manuscript and submission to a journal |  |  |  |  |  |  |  |  |  |  |  |  |
| Revision of manuscript based on reviewers’ comments |  |  |  |  |  |  |  |  |  |  |  |  |
| Publication in a journal |  |  |  |  |  |  |  |  |  |  |  |  |
| Establishment of improved feed troughs at Technology Park |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1122-20** | | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | Research products for more productive, intensive, diverse, profitable and resilient crop (cereals, legumes, and vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | | | |
| b. Activity 1.1.2 | | | Test and disseminate a combination of improved breeds, housing, feeding, health and breeding practices to intensify rearing of livestock (sheep, goat, pig, and poultry) for meat, egg and milk production. | | | | | | | | | | | | | |
| c. Sub-activity GH1122-20 | | | Synthesize previous work on feed and health interventions for improved small ruminant production in Northern Ghana | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | | | Role | | | | | | | |
| Augustine Ayantunde | | | | | ILRI | | | | Coordination of sub-activity, data analysis and drafting of manuscripts | | | | | | | |
| Sadat Salifu | | | | | ARI | | | | Data analysis and drafting of manuscripts | | | | | | | |
| Solomon Konlan | | | | | ARI | | | | Assistance in data analysis | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | | Degree | | Start | End | | |
|  | | | |  | | | | | | |  | |  |  | | |
|  | | | | | | | | | | | | | | | | |
| f. Location(s) | Botingli, Tibali, Duko (Northern Region); Nyangua, Sambologo and Gia (Upper East Region), Passe, Zanko and Guo (Upper West Region) | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| g. Start | July 2015 | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End | March 2021 | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| On-farm study on feed-health interventions for improved small ruminant production was conducted in 3 communities each in Northern, Upper East and Upper West regions involving 90 farmers to evaluate the effect of the intervention on flock dynamic, animal performance (weight changes) and manure production. The study was conducted between 2014 and 2016 but the data collected has not been analyzed and published. Besides, the data collected will be useful as inputs for the regional review paper on livestock feeding strategies So this sub-activity will be a synthesis of the previous work on feed-health interventions for improved small ruminant production in Northern Ghana. Also a medicine lab brief will be produced on feed-health interventions. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| 2.1 The objective of this sub-activity is to synthesize previous work on feed-health interventions for improved small ruminant production in Northern Ghana through production of a journal article, medicine lab brief and contribution to the regional review paper on livestock feeding strategies being led by Africa RISING Ethiopia. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 What are the effects of feed and health package on the flock dynamic and growth performance of sheep and goats in Northern Ghana? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| The data collected between 2014 and 2016 on flock dynamic (birth, death, offtake), weight changes and manure production across all seasons from 90 households in 9 communities will be analyzed and a manuscript will be drafted based on the results from the data analysis. Part of the results will also serve as inputs to the regional review paper on feeding systems and to the medicine label brief. This study had 3 treatments (Treatment 1 = health intervention: vaccination against PPR (Peste de petits ruminants, goat plague) and Pasteurellosis and deworming using Ivermectin; Treatment 2= health intervention as above and supplementary feeding of balanced rations) and a control (Treatment 3 = no health and no feed intervention). The 3 treatments explained above were applied at a village level because of the nature of the treatments (in particular the health intervention). The villages in the same region (3) will be considered as a ‘block’ given that they are close enough and matched enough (on agro-ecological and socio-economic profile). The villages were randomly allocated to one of the 3 treatments. Mixed effect models will be used for ANOVA for any response variable with Region effect (2 degrees of freedom), Treatment effect (2 d.f.) and 4 d.f. for the residual and each treatment has 3 replications / villages. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | | | | Responsibility |
| 5.1 No new data will be collected as existing data will be used | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | | End date | | | |
| 6.1 Draft manuscript on the effect of feed-health intervention on flock dynamic, growth performance and manure production of small ruminants in Northern Ghana | | | | | | | confirmation by journal of receipt of draft manuscript | | | | | | Nov 2020 | | | |
| 6.2 Published journal article on the effect of feed and health intervention on flock dynamic, growth performance and manure production of small ruminants in Northern Ghana | | | | | | | Journal | | | | | | March 2021 | | | |
| 6.3 Input for the regional review paper on feeding systems | | | | | | | Draft manuscript shared with all co-authors | | | | | | Sept 2020 | | | |
| 6.3 Finalization of the West Africa Handbook in collaboration with the co-authors as a team | | | | | | | Handbook revisions | | | | | | Oct 2020 | | | |
| 6.4 Medicine label brief on feed-health intervention | | | | | | | USAID FTF Global Innovation Exchange Platform | | | | | | Oct 2020 | | | |
|  | | | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | | | |
| **Domain** | | **Indicators** | | | | **Metric & Scale** | | **Approach for data collection** | | | | **Before intervention** | | | **After intervention** | |
| Not applicable for a draft manuscript | |  | | | |  | |  | | | |  | | |  | |
|  | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| Publication of the results from the effect of feed and health intervention on improved small ruminant production in Northern Ghana in a scientific journal will facilitate dissemination of the technology to a wide scientific community which can promote scaling. The technology has been partly adopted by many farmers in the three study regions though not as an integrated feed and health package. For example, many farmers continued with vaccination of their sheep and goats against PPR and used different available feed resources as supplement for their animals instead of formulated ration introduced by the project. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | |
| This sub-activity is linked to Sub-activity GH1112-20 on leaf striping for livestock feeding in maize based cropping system. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| * Submitted/published article * Medicine label brief | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed is improved food security for the smallholder crop and livestock farmers as improved small ruminant production will enhance livestock productivity and consequently food security of the farmers. Increase in flock size will enhance offtake thereby improving household income. | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The smallholder crop and livestock farmers, extension agents and scientific community | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | |  | | | | | | |
| **Budget Line** | | | | | | | | | | **ILRI** | | | | | | |
| Personnel | | | | | | | | | | 28,510 | | | | | | |
| Services | | | | | | | | | | 2,500 | | | | | | |
| Supplies | | | | | | | | | | 1,500 | | | | | | |
| Capital | | | | | | | | | | 0 | | | | | | |
| Travel | | | | | | | | | | 1,500 | | | | | | |
| Sub-grantee– Animal Research Institute (ARI) | | | | | | | | | | 5,000 | | | | | | |
| Overhead | | | | | | | | | | 5,852 | | | | | | |
| **Total** | | | | | | | | | | **44,862** | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month/ Week** | **2020** | | | | | | **2021** | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Drafting of manuscript and submission to a journal |  |  |  |  |  |  |  |  |  |  |  |  |
| Revision of manuscript based on reviewers’ comments |  |  |  |  |  |  |  |  |  |  |  |  |
| Publication in a journal |  |  |  |  |  |  |  |  |  |  |  |  |
| Medicine label brief on feed-health interventions |  |  |  |  |  |  |  |  |  |  |  |  |
| Input for regional review paper |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1123-20** | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | |
| a. Output 1.1 | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | |
| b. Activity 1.1.2 | | | Test and disseminate a combination of improved breeds, housing, feeding, health and breeding practices to intensify rearing of livestock (sheep, goat, pig, and poultry) for meat, egg and milk production. | | | | | | | | | | | |
| c. Sub-activity GH1123-20 | | | Assess the effect of feeding maize leaf stripping on digestibility and growth performance of small ruminants and interactions of the technology with child labor (more specifically herding of small ruminants) and school attendance of boys and girls | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | | | Institution | | | Role | | | | | | |
| Addah Weseh | | | | | UDS | | | Feeding, growth and digestibility studies with small ruminants | | | | | | |
| Joseph Awuni | | | | | UDS | | | Economic impact analysis | | | | | | |
| Abdul Rahman Nurudeen | | | | | IITA | | | Growth and husbandry management of maize | | | | | | |
| Gundula Fischer/ Kipo Jimah | | | | | IITA | | | Gender studies and Social impact analysis | | | | | | |
| Bekele Kotu | | | | | IITA | | | Economic impact analysis | | | | | | |
| Benedict Ebito Boyubie | | | | | IITA | | | Develop data collection tools, train the research team on Feed the Future indicators and support in data collection to track output level and Feed the future indicators  Ensure data upload on Dataverse | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | Degree | | Start | End | |
| Joshua K. Adda | | | | UDS | | | | | | MPhil (Animal Science) | | Sept.2020 | Sept. 2021 | |
|  | | | | | | | | | | | | | | |
| f. Location(s) | | Four Africa RISING intervention communities (Cheyohi No. 2, Duko, Tibali and Tingoli) in Northern Region of Ghana. | | | | | | | | | | | | |
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| g. Start | | June, 2017 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | | July 31, 2021 | | | | | | | | | | | | |
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| 1. Justification | | | | | | | | | | | | | | |
| This sub-activity was initially conducted in the year 2019/2020 and is now being conducted for the second season to verify findings from the previous year. In most communities in northern Ghana, livestock are mostly tethered during the rainy season in order not to damage household farms. Feeding small ruminants with nutritious forage during this time can be tedious. As opposed the previous practice of school-going age herding the small ruminants, these days children have to go school. Hence the small ruminants have to be tethered. Fresh maize leaves are free from any anti-nutritional components and have a crude protein content of 8-10%, higher than the minimum requirement of 6% for effective rumen function. Fresh immature maize strippings are also higher concentrations in soluble sugars. This study was started last year (2019) and will need additional year’s data in order to make meaningful conclusions on the impact of the project on the feeding small ruminants with maize strippings and the opportunity the project makes available for the boy-child to go to school in the morning and to graze small ruminants after school. This study will put into consideration the application of the Sustainable Intensification Assessment Framework (SIAF) which has 5 domains (Productivity, Economic, Environment, Human and Social). The first-year study focused on productivity domains leaving the economic and social domains. The data from the SI domains which were not captured during the first year will now be captured during the second year of the study.  Maize strippings will be obtained from Sub-activity GH1112-20 undertaken with IITA in Tamale as previously done. | | | | | | | | | | | | | | |
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| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 Collect and validate the data on the nutritional quality (nutrient analysis and digestibility) and utilization (growth performance) of maize strippings fed to small ruminants | | | | | | | | | | | | | | |
| 2.2 Evaluate interactions of the technology with livestock feeding/herding roles at the household level and potential implications on children’s school attendance | | | | | | | | | | | | | | |
| 2.3 Determine the cost-benefit analysis of the leaf stripping feeding experiment at the household level | | | | | | | | | | | | | | |
| 2.4 Assess the quality of meat obtained from small ruminants supplemented with or without maize strippings | | | | | | | | | | | | | | |
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| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What is the effect of feeding small ruminants on leaf strippings in the morning and grazing them in the afternoon growth and digestibility compared to grazing them all day on natural pasture? | | | | | | | | | | | | | | |
| 3.2 How does the application of the technology affect livestock feeding/herding roles and the school attendance of boys and girls? | | | | | | | | | | | | | | |
| 3.3 Will supplementing small ruminants with leaf strippings affect meat quality (sensory assessment)? | | | | | | | | | | | | | | |
| 3.4 What is the cost-benefit ratio of feeding leaf strippings on household income? | | | | | | | | | | | | | | |
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| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| **4.1 Study Area**  The study will be carried out in 4 Africa RISING intervention communities (Cheyohi No. 2, Duko, Tibali and Tingoli) in Northern Region of Ghana.  The study will be repeated for the 2020/2021 cropping season to validate data collected last year and to and to investigate the interactions of the technology with school attendance.  **4.2. Growth performance experiment**  Six farmers already working with the Africa RISING project will be selected in each community (Cheyohi No. 2, Duko, Tibali and Tingoli) for the trial. About 5-6 lambs and kids (15.0 ± 2.0 kg) will be selected from each farmer’s pen. These will be offered a weighed amount (2.5% of body weight) of fresh maize strippings harvested after tusselling. The strippings will be offered to tethered sheep and goats in the pen at home. The animals will be offered the strippings and water at *ad libitum* twice daily; in the morning (7-8 AM) and in the evening (2-3 PM) when children return from school. Left overs will be collected and weighed daily to estimate daily intake whereas the small ruminants will be weighed at the beginning and biweekly until the end of the study. The second group of farmers (control) will graze their sheep and goats on natural pasture without any maize stripping supplementation. Thus treatments (Leaf stripping and Control) will be replicated twice with farmer as the replicate and community as a block. Approximately 24 lambs and kids will be required in each community for the study. Data collected will include feed intake and growth performance (average daily gain). The protocol for this experiment will be reviewed and by the Research Ethics Committee of the University for Development Studies (UDS).  **4.2.2.1. Sensory evaluation of meat**  One sheep and one goat each will be purchased from farmers involved in the experiment voluntarily. They will be slaughtered at the Meat Unit of the UDS for carcass characteristics (dressing percentage, carcass weight, drip losses) and sensory evaluation of carcass and meat, respectively. Sensory/eating quality evaluation will be done according to the methods described by Miller (2017; <https://doi.org/10.1016/B978-0-08-100694-8.00015-7>).  **4.2.2.2. In situ digestibility**   * Subsamples of maize strippings collected and pooled biweekly will be thoroughly mixed and weighed (5 g per bag) into monofilament polyester bags (8 cm10 cm; 51-mm pore size; Sefar America Inc., Depew, NY). Duplicate polyester bags for each sampling time point will be incubated in the rumens of three ruminally fistulated sheep for 1, 2, 4, 8, 16, 24, 48 and 72 h. Bags will be placed into large mesh retaining sac (3- to 5-mm pore size) to ease retrieval. Kinetics parameters of in situ dry matter disappearance (DMD) will be estimated by a non-linear regression procedure of SAS software (SAS Institute, Inc. 1998) using the models of Ørskov and McDonald (1979; <https://doi.org/10.1017/S0021859600063048>). The cannulated sheep will be offered a regular forage diet during the digestibility trial. Details of the in-situ procedure have previously been described (Addah et al., 2011; <https://doi.org/10.4141/cjas2012-016>).   **4.2.2.3. Socioeconomic studies**  A semi-structured questionnaire will be designed and used to obtain data on the social and economic impact of feeding leaf strippings to sheep and goats at the household level. This will include data on cost-benefit economic analysis of feeding maize strippings. For the gender study (on school attendance) focus group discussions will be conducted as well as a short survey and a small number of key informant interviews.  **4.2.2.4. Chemical analysis**  For chemical analysis, dry matter of fresh strippings will be determined by drying at 60oC for 48 h in a forced air oven. Organic matter will be determined by ashing samples (1 g) in a muffle furnace at 550oC for 5 h. During chemical analysis, subsamples of the leaf strippings collected and stored weekly will be pooled into biweekly samples and ground through a 1-mm screen prior to analysis of NDF and ADF using the Van Soest method (Van Soest, 1991). The solution for analysis of neutral detergent fiber (NDF) will include sodium sulfite and α-amylase. Both NDF and ADF values will be expressed inclusive of residual ash.  Crude protein will be determined by the proximate analysis procedure of the AOC (2005) in which CP will be determined by the Kjeldhal procedure and estimated as total N × 6.25.  **4.3 Data analysis**  Data obtained from both experiments will be subjected to analysis of variance (ANOVA) using SAS version 9.2. In situ DMD degradability, dry matter intake and growth performance (weight gain, ADG etc) of small ruminants will be analyzed using the PROC MIXED procedure of SAS as a completely randomized design with lambs/kids as the experimental unit in the growth performance, and the cannulated sheep as block and each nylon bag as experiment unit in digestibility study. The initial weight of the animals will be used as covariate for the analysis of the growth performance data. A 2 × 2 factorial treatment arrangement will be used to analyzed the interaction effect of feeding (Leaf strippings or Control) and small ruminant type (sheep or goat) on growth performance and sensory evaluation parameters. Data on Socioeconomic and eating quality of meat will be analyzed with the PROC REG and PROC CATMOD procedures of SAS.  Differences in least-square means were declared significant at *P* ≤ 0.05. | | | | | | | | | | | | | | |
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| 5. Data to be collected and uploaded | | | | | | | | | | | | | | Responsibility |
| 5.1 Planting and husbandry practices for cultivation of maize at project sites | | | | | | | | | | | | | | IITA |
| 5.2 Growth and digestibility experiments | | | | | | | | | | | | | | UDS |
| 5.3 Gender study (school attendance) | | | | | | | | | | | | | | UDS/IITA |
| 5.4 Cost-benefit analysis | | | | | | | | | | | | | | IITA/UDS |
| 5.5 Proxies for resilience and livelihood enhancement: labor hours saved, quantity of fodder and number of grazing-free days offered to farmer as a result of fodder from stripped maize leaves, estimated avoided weight loss from number of kilometers an animal would walk in search of fodder, % risk reduction from avoided animal thefts while grazing, and avoided disease levels | | | | | | | | | | | | | | IITA/UDS |
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| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | End date | | |
| 6.1 Data on school attendance | | | | | | | Project semi-annual report | | | | | May 2021 | | |
| 6.2 Database on growth and digestibility of small ruminants | | | | | | | Dataverse | | | | | January 2021 | | |
| 6.3 Data on meat quality | | | | | | | Dataverse/ Final Technical Report | | | | | February 2021 | | |
| 6.4 Publication (Ghana Journal of Animal Science) | | | | | | | Ghana Journal of Animal | | | | | December 2021 | | |
|  | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | |
| **Domain** | **Indicators** | | | | | **Metric & Scale** | | | **Approach for data collection** | | **Before intervention** | | | **After intervention** |
| 7.1 Productivity | 1. Animal productivity  (daily growth rate, weight gain)  2. Digestibility (dry matter, neutral detergent fibre)  3. Carcass characteristics (carcass weight, dressing percentage, percentage drip loss) | | | | | 1. -Weight gain/day,  2. Percentage of leaf strippings digestible  3. Carcass weight, marbling, visceral fat etc | | | 1. Maize stripping Feeding experiment  2. Maize stripping digestibility experiment  3. Sensory evaluations | | 1. Gain/day =  -22g/d  2. Dry matter digestibility of maize strippings = 40%  3. Higher (15%) carcass drip losses  4. Higher incidence of digestive disorders/diseases | | | 1. Gain/day = -40g/d  2. Dry matter digestibility of maize strippings = 58%  3. Lower carcass drip losses (15%)  4. Lower incidence of digestive disorders/diseases |
| 7.2 Environmental | Manure quality | | | | | Concentration of N and other nutrients | | | Laboratory analysis | | N concentration low | | | N concentration improved by feeding leaf strippings |
| 7.3 Economic | Profitability (cost-benefit analysis of feeding maize strippings) | | | | | Household income | | | Semi-structured questionnaire and focus group discussion | | Lower contribution of small ruminants to household income | | | Contribution of small ruminants to household income is increased |
| 7.4 Social | School attendance | | | | | * Qualitative: potential for increasing school attendance | | | 1. Key informant interviews  2. FGDs  3. Survey | | Higher absenteeism of children | | | Lower absenteeism |
| 7.5 Human | Meat eating quality analysis | | | | | Tenderness, flavour, appearance/  colour, juiciness etc, | | | Consumer panel sensory evaluation through:  1. Descriptive analysis (colour, texture, marbling etc)  2. Consumer acceptance and preference testing analysis (flavour, juiciness, tenderness etc.) | | 1. Higher incidence of dark, dried and firm (DDF) meat.  2. Mutton/chevon from study locations have lower eating quality  3. Consumer acceptance and preference of mutton/chevon low | | | 1. Lower incidence of dark, firm and dried (DDF) meat  2. Eating quality of mutton/chevon from study locations improved  3. Consumer acceptance and preference of mutton/chevon higher |
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| 8. How will scaling be achieved? | | | | | | | | | | | | | | |

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| Scaling will be achieved by conserving surplus leaf strippings for sale as a source of household income.  This will enable the households/farmers to take up the technology as a source of household income  The district Research-extension-farmer committee of MoFA will be involved in this intervention ensuring sustainability in the scaling up. |
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| 9. How are the activities in this protocol linked to those of others? |

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| This work will rely the agronomic experiment *Optimizing on-farm nitrogen (N) use efficiency under rainfed condition in maize-based cropping system (Sub-activity GH1111-20)* undertaken by IITA (courtesy Dr. Nurudeen Abdul-Rahman)  Through the gender study the activity is linked to Terry’s activity and Ayantunde’s activity (please insert sub-activity numbers. | | | |
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| 10. Custom indicators | | | |
|  | | | |
| * Project semi-annual report * Growth and digestibility database * Journal publication * Technology brief | | | |
|  | | | |
| 11. Impact-based summary matrix | | | |
| 11.1 What is the development challenge you are addressing? | | | |
| This sub-activity is expected to help address the following major development challenges in the intervention communities.   * Household food and income insecurity and natural resource management. * Human resource development (opportunity for children to attend school) | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers, extension agents, and policymakers | | | |
| * Livestock farmers * Children * Ghana Education Service * MoFA | | | |
|  | | | |
| 12. Budget (US$) for sub activity GH1113-20 |  |  |  |
| **Budget Line** | **IITA1** | **UDS** | **WorldVeg** |
| Personnel | 2,500 | 7,500 |  |
| Services | 6,500 | 4,000 |  |
| Supplies | 0 | 15,0002 |  |
| Capital | 0 | 0 |  |
| Travel | 2,500 | 4,500 |  |
| Overhead | 0 | 6,000 |  |
| **Total** | **11,500** | **37,0003** |  |
| **Grand Total = 48,500** | | | |
| 1Thesefunds will be distributed to IITA staff involved in the study  2Small ruminants (sheep/goats) will be sampled experimental animals (bought from farmers) at the end of the study for carcass and meat eating quality analysis at the MEAT UNIT of the UDS, Nyanakpala Campus.  3Includes costs of paying graduate student tuition fees and running and maintaining one motor bicycle in the project communities and for laboratory analysis of feeds, manure and digestibility | | | |
| -Included 1,500 for IITA Gendered studies on the services budget line. | | | |

13. Gantt chart

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| **Year/Month** | **2020** | | | | | | | **2021** | | | | | | | |
| **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Farmer sensitization |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Training of Field Technicians |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Graduate student enrollment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Field evaluation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Leaf stripping and feeding |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Digestibility trial |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Administration of economic and social impact questionnaire at the household and school level |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Laboratory analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data processing and analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Semi-annual report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Final report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Journal publication |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1211-20** | | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | | |
| a. Output 1.2 | | | | Integrated management technologies and practices to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated with farmers and development partners in the intervention communities. | | | | | | | | | | | | |
| b. Activity 1.2.1 | | | | Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and ecosystems services at the farm and landscape/watershed. | | | | | | | | | | | | |
| c. Sub-activity GH1211-20 | | | | Assessing buffer and adaptive capacity to harness the resilience of different farm types. | | | | | | | | | | | | |
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| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | | | | | | | |
| Mirja Michalscheck | | | WUR | | | | Modeling and farmer interaction | | | | | | | | | |
| Jeroen Groot | | | WUR | | | | Activity coordinator | | | | | | | | | |
| Benedict Boyubie | | | IITA | | | | FtF indicators and ensure data upload on Dataverse | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | |
| Name | | | Institute | | | | | Degree | | Start | | | | End | | |
| Vacant | | | WUR | | | | | MSc | | Sep. 2019 | | | | Mar. 2020 | | |
| Eva Thuijsman | | | WUR | | | | | PhD | | Feb. 2019 | | | | Feb. 2023 | | |
|  | | | | | | | | | | | | | | | | |
| f. Location(s) | Districts in NR, UER, UWR | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| g. Start | September 2019 | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End | September 2020 | | | | | | | | | | | | | | | |
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| 1. Justification | | | | | | | | | | | | | | | | |
| Vulnerability and resilience are two crucial attributes of smallholder farming systems that can be used for analyzing the response to disturbances. We will assess these properties in relation to the buffer and adaptive capacity, which depend on the ‘window of opportunities’ of possible changes in terms of productive, socio-economic and environmental performance indicators, i.e. the ‘solution space’. The vulnerability of the system can be quantified as the distance of selected performance indicators between original and disturbed systems. The buffer capacity will be derived from the size of the solution space that could be obtained after reconfiguration of farm components (crops, animals, fertilizers, etc.) that were present on the original farm, whereas the assessment of adaptive capacity was derived in a similar way but after allowing innovation by introducing new components to the farm. These features will be different for the various farm types in the three regions in northern Ghana since they depend on the context (biophysical and socio-economic) and the resources and activities of farms and households. Below we describe the conceptual basis. The activity builds on existing datasets of farm and household structure and farming (from surveys such as GARBES) practices and the proposed and tested Africa RISING technologies (from project scientists).  **Conceptual basis**  A disturbance can be a pest, a drought or a product price decline that negatively affects the farming system performance. The farmer can prepare for or respond to a disturbance by reconfiguring the farm with changes in for instance crop areas, animal numbers, amounts of inputs, selected market channels or management practices to compensate for the effect of the disturbance. The available options for adjustment of the system with existing components and resources can be considered as the ‘buffer capacity’. When the farmer decides to introduce new crops, animals, inputs or practices, the required adjustment and reconfiguration (both in the ecological system and in farm management) is expected to be considerably larger than for the buffer capacity and is reflected in the ‘adaptive capacity’. This illustration of the concepts for an agroecosystem demonstrates that besides the ecological (self-) organization, the farmer, his flexibility and skills, and his cognitive and managerial capacities will determine the chosen strategy of adaptation and the final effectiveness of reconfiguration, and thus agroecosystem resilience.  All possible combinations of values of performance indicators constitute the ‘window of opportunities’ or ‘solution space’ for a particular system. The potential of a system (P), resulting from the buffer and adaptive capacity, can be derived from the size of the solution space, which defines the options for adjustment of the system. The solution space is delimited by the Pareto frontier (or Pareto surface when more than two performance criteria are included in the analysis), and for assessment of resilience, we consider only options that perform at least as good as the existing system. The Pareto frontier can be established using multi-objective optimization, and the area (in 2 dimensions), volume (3 dimensions) or hyper volume (>3 dimensions) of the solution space can be calculated, for instance, relative to a given reference point that represents the existing situation.  This is demonstrated in Figure 1, wherein only the portion of the solution space with improvements in two system indicators (productivity and environmental quality in this case) relative to the existing situation after a disturbance is depicted. The buffer capacity (area B in Figure 1a) is estimated as the solution area corresponding to the reconfiguration of links and flows among the components that are already in the system. The adaptive capacity (area A in Figure 1a) is estimated as the expansion of the solution area when new components are introduced in the system. The potential (P) is estimated as the sum of areas A and B.  Macintosh HD:Users:jeroengroot:Dropbox:Artikelen:027 Resilience:Submitted ES:Figure 1.gif  ***Figure 1.***Portions of solution spaces with future options that perform better for two generic objectives, productivity and environmental quality, relative to disturbed states denoted by red symbols. (a) After a disturbance, the system states change following the arrow from point 1 to point 2 (vulnerability v is the distance between points 1 and 2) and move to a more desirable state such as point 3 (resilience r is the distance between points 2 and 3). Area A represents the adaptive capacity and B the buffer capacity of the system after the disturbance. Potential P is calculated are the sum of areas A and B. White symbols denote alternatives for the current system. (b) The potential of a system at consecutive moments in time, with changing attained states (points 1, 3, 5 and 7) and after disturbances (points 2, 4 and 6). | | | | | | | | | | | | | | | | |
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| 2. Objectives | | | | | | | | | | | | | | | | |
| 2.1 Analyze input-output relations for farm production activities (cropping, animal husbandry, etc.) | | | | | | | | | | | | | | | | |
| 2.2 Quantify potential effects of disturbances on-farm production activities for multiple performance indicators | | | | | | | | | | | | | | | | |
| 2.3 Model farm/household level effects of disturbances to assess vulnerability for different farm types | | | | | | | | | | | | | | | | |
| 2.4 Quantify the buffer and adaptive capacity of farms and households of different types | | | | | | | | | | | | | | | | |
| 2.5 Establish pathways to harness farm and household resilience for different farm types | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 To what extent are productive, socio-economic and environmental performance indicators at the farm and household level affected by biophysical and socio-economic disturbances (e.g. drought, price fluctuation) | | | | | | | | | | | | | | | | |
| 3.2 What are the buffer and adaptive capacity of different farm and household types for disturbances in terms of selected productive, socio-economic and environmental performance indicators? | | | | | | | | | | | | | | | | |
| 3.3 Which efficient pathways for performance improvement can be used to recover after disturbances by different types of farms or households? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures(survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| * FarmDESIGN modeling using existing parameterized farms/ households for three farm types per region * Inventory of production activities that are used on farms or tested by the project (technologies), these production activities (inputs and outputs) are added to the farm models as input data but can also be used to validate the models * Individual discussions and focus group discussions with farmers and experts to assess the feasibility of changes pathways to harness resilience * Surveys, focus group discussions, farming systems modeling and a serious game. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded to Dataverse | | | | | | | | | | | | | Responsibility/Institute | | | |
| Is the collected data part of a multi-year experiment/ trial? Yes | | | | | | | | | | | | |  | | | |
| 5.1 Parameterized model for various farm types per region | | | | | | | | | | | | | WUR | | | |
|  | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | | | Delivery date | | | |
| 6.1 Journal article | | | | | | PDF of the submitted paper | | | | | | | Sep. 2020 | | | |
| 6.2 MSc thesis student report | | | | | | PDF of report | | | | | | | Sep. 2020 | | | |
|  | | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | | | | |
| **Domain** | | **Indicators** | | | **Metric & Scale** | | | | **Approach for data collection** | | | **Before intervention** | | | | **After intervention** |
| 7.1. Productivity | | Crop productivity | | | Crop yields (kg/ha/year) under regular and disturbed conditions (at field and farm levels) | | | | Field studies from Africa RISING | | |  | | | |  |
| Animal productivity | | | Animal products (kg/animal/year) under regular and disturbed conditions (at animal and farm levels). | | | | Empirical evidence | | |  | | | |  |
| Input use efficiency | | | Product per input (at field, herd and farm levels) | | | | Modelled | | |  | | | |  |
| 7.2. Economic | | Profitability | | | Gross margin of crop and animal operations and operating profit of farm operation (USD) | | | | Calculated/Computed | | |  | | | |  |
| Labour requirement | | | Labour requirements at field, animal, herd, farm and household levels | | | | Calculated/Computed | | |  | | | |  |
| 7.3 Environment | | Soil chemical quality | | | Carbon and nutrient (N, P, K) budgets, losses to air and soil (at field and farm levels) | | | | Empirical evidence | | |  | | | |  |
| 7.4 Human condition | | Nutrition | | | Nutrient production (kg/year) at field and farm levels | | | | Empirical evidence | | |  | | | |  |
| Food security | | | Food production (kcal/year) at field and farm levels | | | | Empirical evidence | | |  | | | |  |
| Capacity to experiment | | | Willingness to implement a new farm configuration after disturbance | | | | Previous FGDs data | | |  | | | |  |
| 7.5 Social | | Equity | | | Rating of farm configurations per group and agency (leadership roles) | | | | Previous FGDs data | | |  | | | |  |
|  | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| Our assessment builds upon a locally validated but general pattern of inter- and intra-household diversity. Since our case study households have been selected as representative for farm types of different resource endowment, we expect our findings to be relevant to most other farms of the same type. (We envision to test the transferability of our results by Focus Group Discussions and individual consultations beyond the current case study site in order to ensure greater validity.) Our findings are meant to guide Africa RISING’s scaling effort, in that we reveal how the resilience of the different farm and farmer types can be improved best by which of the Africa RISING technologies. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | |
| The modelling exercise builds on past and ongoing Africa RISING trial data i.e. data from the technology parks as well as the farmer-led baby- and upscaled trials. The models will be updated, extended and tested in close collaboration with the Africa RISING-regional coordinators and other project experts in Tamale (NR), Navrongo (UE) and Wa (UW). | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | |
| * Journal article * MSc thesis student report | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed is improving our understanding of how smallholder farming systems respond to disturbances and assess their vulnerability and resilience. | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The target audience is smallholder crop and livestock farmers and extension agents. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | | |
| **Budget line item** | | | | | | | | | | | **WUR (FSE)** | | | | **WUR (PPS)** | |
| Personnel | | | | | | | | | | | 0 | | | | 0 | |
| Services | | | | | | | | | | | 0 | | | | 0 | |
| Supplies | | | | | | | | | | | 0 | | | | 0 | |
| Capital | | | | | | | | | | | 0 | | | | 0 | |
| Travel | | | | | | | | | | | 0 | | | | 0 | |
| Overhead | | | | | | | | | | | 0 | | | | 0 | |
| Total | | | | | | | | | | | **0** | | | | **0** | |
| **Grand total** | | | | | | | | | | | **0** | | | | | |
| \*\*\* There was no budget assigned for 2020/2021 since the sub-activity was carried over from 2019/2020 and is in the process of finalizing the deliverables | | | | | | | | | | | | | | | | |

13. Gantt chart

|  |  |
| --- | --- |
| **Activity** | **Year 2020** |
| **Month** | J | F | M | A | M | J | J | A | S |
| Starting | |  |  |  |  |  |  |  |  |  |
| Preparation of farm modelling | |  |  |  |  |  |  |  |  |  |
| Field work in three regions | |  |  |  |  |  |  |  |  |  |
| Processing and reporting results | |  |  |  |  |  |  |  |  |  |
| Drafting paper for scientific journal | |  |  |  |  |  |  |  |  |  |
| Revising paper and submission to journal | |  |  |  |  |  |  |  |  |  |
| Ending | |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1212-20** | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | |
| a. Output 1.2 | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | |
| b. Activity 1.2.1 | Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and ecosystems services at the farm and landscape/watershed levels. | | | | | | | | | |
| c. Sub-activity GH1212-20 | Assess the impact of soil and water conservation interventions in a maize - cowpea living mulch system | | | | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | | Institution | Role | | | | | | |
| Wilson Agyei Agyare | | | KNUST, Kumasi | PI: Soil and water management | | | | | | |
| Fred Kizito | | | IITA | Co-PI: Land and water management | | | | | | |
| B. O. Antwi | | | Soils Research Institute, Kumasi | Soil and water management support | | | | | | |
| Abdul Rahman Nurudeen | | | IITA | Cereal agronomy and plant nutrition | | | | | | |
| Gundula Fischer | | | IITA | Gender and social aspects | | | | | | |
|  | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | |
| Name | | | Institute | | | Degree | | | Start | End |
| Ernestina Anan | | | KNUST | | | MPhil | | | 2018 | 2020 |
| Benjamin Donkor | | | KNUST | | | MPhil | | | 2019 | 2021 |
|  | | | | | | | | | | |
| f. Location(s) | | | Northern (Tingoli, Cheyohi no. 2, Doku, Tibali) | | | | | | | |
|  | | | | | | | | | | |
| g. Start | | | July 2017 | | | | | | | |
|  | | | | | | | | | | |
| h. End | | | December 2020 | | | | | | | |
|  | | | | | | | | | | |
| 1. Justification | | | | | | | | | | |
| **Justification of sub-activity in relation with previous activities:**  This sub-activity started in 2017 and has accumulated a data set that will culminate in a MSc. Degree in Kwame Nkrumah University of Science and Technology. The field work and data collection were completed in 2019. The team is currently conducting data consolidation, analysis, and synthesis for publication. Two manuscripts are being prepared under this sub-activity:   1. Soil moisture relations and dynamics within a maize-cowpea living mulch system 2. Implications of seasonal variation of soil moisture and nutrient dynamics in smallholder farming systems: The case for Northern Ghana. | | | | | | | | | | |
|  | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | |
| 2.1 Assess soil moisture and nutrient flux benefits associated with a maize-cowpea living mulch intercrop | | | | | | | | | | |
| 2.2 Map, engage and collaborate with strategic partnerships as a means to scale out promising SWC measures | | | | | | | | | | |
| 2.3 Contribute to completion of West Africa Handbook Chapter on Land &water management strategies in Cereal-Legume farming systems | | | | | | | | | | |
|  | | | | | | | | | | |
| 3. Research Questions | | | | | | | | | | |
| 3.1 How much soil moisture is retained/increased/depleted within maize-cowpea living mulch systems and how does this impact on corresponding crop yields? | | | | | | | | | | |
| 3.2 What would be the best strategy to map, engage and collaborate with strategic partnerships in the Region as a means to scale out promising SWC measures? | | | | | | | | | | |
|  | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | |
| 1. The field work on soil and water conservation measures specifically, using cowpea living mulch as the principal intervention in the technology park and farmers’ practices on their fields as controls was complemented with crop modelling of water and nutrient flows with the APEX model. The study built on previous results for evaluation of soil conservation practices towards environmental integrity (allowing moisture infiltration, reducing erosion and nutrient losses). 2. Assessment of the knowledge, attitude, skills and aspirations (KASA) of farmers before and after the training and capacity building exercises were conducted. The sub-component on this entailed training and capacity building needs of all the target beneficiaries. 3. The team will refine content from the already submitted West Africa Handbook Chapter on Land & water management strategies in Cereal-Legume farming systems towards completion to a final version. | | | | | | | | | | |
|  | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | Responsibility/Institute | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | |  | | |
| Soil loss, soil moisture content, nutrient variations, soil hydraulic properties. | | | | | | | | KNUST/IITA | | |
|  | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | |
| Deliverables | | | | | Means of verification | | | | | |
| 6.1 Database on land and water management strategies in cereal-legume farming systems | | | | | Dataverse | | | | | |
| 6.2 Publications on land and water management strategies in cereal-legume farming systems:   1. Soil moisture relations and dynamics within a maize-cowpea living mulch system 2. Implications of seasonal variation of soil moisture and nutrient dynamics in smallholder farming systems: The case for Northern Ghana. | | | | | Journal Articles | | | | | |
| 6.3 West Africa Handbook Chapter: Land and water management strategies in Cereal-Legume based farming systems | | | | | Updated and completed handbook chapter | | | | | |
|  | | | | | | | | | | |
| 7. Sustainable intensification indicators   | **Sustainable intensification indicators for Sub-activity GH3211-19** | | | | | | | --- | --- | --- | --- | --- | --- | | **Domain** | **Indicator** | **Metrics and scale of measurement** | **Methods/Approaches taken including duration** | **Before intervention** | **After intervention** | | **Productivity** | Crop productivity | Yield (kg/ha/season) at the field/plot level | Agronomic trials (See GH111-19) for 2017, 2018 and 2019 |  |  | |  |  | | **Environmental** | Erosion | Soil retention (tons/ha/season) at the plot level | - Field measurements  - Modelling with SWAT and APEX |  |  | | Soil water storage | Seasonal soil moisture storage mm/m | Environmental research (See GH 1212-19) |  |  | | **Economic** | Profitability\* | Net income ($/kg/ha/season) at the plot level | Econometric analysis based on productivity data (combined both maize and cowpea productivity data) |  |  | | Input Use Intensity | Input per ha at the plot level | Econometric analysis based on environmental data |  |  | | **Social** | Gender equity | Capacity: Access to information (Household)  Percentage (%) | Surveys and FGDs using direct engagements and electronic tools (Insyt and Kobo Collect) |  |  | | Collective action | Participation in a collective action group (% Household) |  |  | | **Human** | Capacity to experiment | Number of new practices being tested (Household level) | Using ICT and GIS tools (See GH4121-19 |  |  | |  | % of farmers experimenting (Community level) | Surveys and FGDs |  |  |   \*<https://esoko.com/food-prices-in-ghana-january-2020/> | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | |
| Strategic partnerships with both public and private sector entities. The project team is continuing to liaise with MoFA, the private sector specifically WorldCover, SEEDPAG and other local universities including UDS. This will include sharing with them brochures developed for farmer training as well as co-sharing in-field experiences at working group discussions including Agriculture Extension Officers as key change agents. | | | | | | | | | | |
|  | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | |
| The activities are related to sub-activity GH1111-19 entitled “Cowpea living mulch effect on weed control, soil properties and maize yield”. This is an integrative activity in which IITA, and KNUST collaborated on soil and water conservation incorporation within farming systems. The work also closely linked with IITA on cereal-legume cropping systems and mimicked the soil and water conservation approaches that incorporate living mulch in farming systems that have been successfully implemented previously in West Africa. Insights from our work will be shared with IWMI for cross-learning opportunities between soil/land management strategies and water management interventions within the target farming systems. | | | | | | | | | | |
|  | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | |
| * Journal articles on land and water management strategies in Cereal-Legume farming systems * Handbook chapter for West Africa * Database on land and water management strategies in Cereal-Legume based farming systems | | | | | | | | | | |
|  | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Food insecurity and poverty (household level) and NRM (from plot level to landscape level). Through this research, the sub-activity will seek and subsequently share information that preserves the natural resource base through soil conservation thus increasing productivity and contribute towards reducing food insecurity and poverty. | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Smallholder farmers, agricultural extension agents | | | | | | | | | | |
|  | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | |
| **Budget line item** | | **IITA** | | | | | **KNUST** | | | |
| Personnel | | - | | | | | 4,900 | | | |
| Services | | 4,000 *(Graphics development and Open access charges)* | | | | | 2,000 *(Student services)* | | | |
| Supplies | | 3,000 | | | | | 1,000 | | | |
| Capital | | - | | | | | 2,000 | | | |
| Travel | | 2,000 | | | | | 900 | | | |
| Overhead | | 0 | | | | | 880 | | | |
| **Total** | | **9,000** | | | | | **11,680** | | | |
| **Grand total** | | **20,680** | | | | | | | | |

13. Gantt chart

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | **2021** | | | |
| **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Finalize 2 Journal articles |  |  |  |  |  |  |  |  |  |
| Finalizing content of Technology Handbook chapter (Includes support to other Handbook chapters) |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1221-20** | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | |
| a. Output 1.2 | | Integrated management practices and innovations to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated with farmers and development partners in the intervention communities. | | | | | | | | | | |
| b. Activity 1.2.2 | | Test and promote water management technologies and practices to increase water productivity in small-scale crop-livestock farming systems under rainfed and irrigated condition | | | | | | | | | | |
| c. Sub-activity GH1221-20 | | Evaluate the technical and agronomic performance of solar-powered and Bhungroo based small scale irrigation systems in the Upper East Region of Ghana | | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | Institution | | | Role | | | | | | | |
| TBD | | IWMI | | | Agricultural Water Management Expert responsible for the evaluation of the technical and agronomic performance of solar-powered and Bhungroo based small scale irrigation systems | | | | | | | |
| Solomie Gebrezgabher | | IWMI | | | Responsible for economic analysis | | | | | | | |
| Olufunke Cofie | | IWMI | | | Overall Project Support and integration | | | | | | | |
| Benedict Boyubie | | IITA | | | FtF indicators and ensure data upload on Dataverse | | | | | | | |
|  | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | |
| Name | | | | Institute | | | | Degree | Start | | End | |
|  | | | | | | | | | | | | |
| f. Location(s) | Upper East Region | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | September 2019 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | May 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **1. Justification** | | | | | | | | | | | | |
| Northern Ghana is the agricultural production hub of the country, creating employment for the majority of the adult population. Unlike the south where two rainfall patterns are experienced, Northern Ghana has only one rainy season within which farmers maximize production before the dry season sets in. This notwithstanding, the rainy season also comes with some challenges such as heavy floods which destroy farmlands, farm produce and infrastructure (Ofosu-Antwi *et al*., 2017). These occurrences affect livelihoods of especially smallholder farmers in terms of food security and incomes.    Irrigation development offers the promise of food security and poverty alleviation in northern Ghana. However, all rivers except the Volta and its major tributaries dry up in the dry season. Farmers practicing dry season production, mostly rely on shallow groundwater, which normally dries up before the end of the dry season (Maisiri *et al*., 2005)16. It is against this backdrop that the Bhungroo technology was introduced to provide water supply for dry season crop production through aquifer storage and recovery. The concept of enhancing groundwater recharge through the Bhungroo technology for dry season crop production started with the implementation of the “Enhancing ecosystem services for smallholder women farmers in the northern region of Ghana through an integrated Bhungroo based research” project funded by the CGIAR Research Program on Water, Land and Ecosystems (WLE). This project resulted in the construction of two Bhungroo systems.  A follow-up to this project was the “Securing Water for Improved Seed and High-Value Vegetable Production in Flood-prone areas of Northern Ghana” (SecureWater) Project funded by the FtF’s Agriculture Technology Transfer Project (ATT) led by the International Fertilizer Development Centre (IFDC). The project was implemented by the International Water Management Institute (IWMI) in partnership with Conservation Alliance (CA) and Ghana Irrigation Development Authority (GIDA). In total, the two projects installed five solar-powered and one diesel-powered pump in six communities.  During the 2019/2020 dry season cultivation period, activity GH1222-2 of the Africa RISING project was initiated to test the technical and agronomic performances of the newly constructed Bhungroo and solar-based irrigation systems to strengthen the existing data generated from other sites. The ultimate aim was to generate robust data to develop Bhungroo based and solar-powered irrigation business models (including economic feasibility) for northern Ghana and beyond. Most farmers in the region rely on their judgement and apply high volumes of water to make up for losses due to high evapotranspiration in the dry season without regard to the actual water requirement of the crop thus resulting in very low efficiencies. Although water management solutions offer greater security to agricultural production and expand the options for sustaining livelihoods as well as ensuring food security and nutrition (Domenech, 2014), the efficiency of water in agricultural production is low at farm level. Generally, the crop effectively uses only 40 to 60% of the water applied, the rest is usually lost through various processes including evaporation, runoff, and percolation into the groundwater. It is crucial to ensure that the right amount of water is applied at the right time to avoid waste of water and energy. This can be achieved using drip irrigation and deficit irrigation technologies.  Drip irrigation allows controlling precisely the application of water by allowing water to drip slowly near the plant roots through a network of valves, pipes, tubing, and emitters (Burney, 2012). With limited water available during the dry season and the high capital investment costs of the Bhungroo and solar-based irrigation system, it is imperative that the water is used wisely and with the highest possible efficiency to generate the highest possible return on investment. This triggers the use of efficient water application methods such as drip irrigation systems. The main benefit obtained from the system is the opportunity to do dry season irrigation of high-value crops. The experiments aim to evaluate the technical and agronomic performance of Bhungroo and solar-based irrigation. Moreover, this research generates input data for the development of business models related to solar-powered irrigation systems in north Ghana and similar agro-ecologies. This activity benefited from the Bhungroo and solar irrigation infrastructure, which was funded by WLE and Secure Water projects. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **2. Objectives** | | | | | | | | | | | | |
| 2.1 Evaluate the technical and agronomic performance as well as the economic feasibility of solar-powered drip irrigation system in two communities | | | | | | | | | | | | |
| **3. Research questions** | | | | | | | | | | | | |
| 3.1 How effective is Bhungroo and solar-based energy under the different drip irrigation systems and what would be the economic feasibility for small sale farmers? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.)** | | | | | | | | | | | | |
| This procedure is for the actual field experimentation. The activity is embedded in the action research outlined under the proposed systemic scaling pathway analysis in outcome 3.  The field study will be conducted using four irrigation regimes in two communities (Sepaat and Gogoro). The four irrigation regimes include i) Drip 1 (100% of the Crop water requirement), ii) drip 2 (80% of crop water requirement, iii) drip 3 (65% of the crop water requirement), iv) Farmers’ practice. The deficit irrigation treatments (85% and 65%) are adopted using previous research results such as Liu *et al*. (2006)19 and Kang *et al*. (2000)20. Youths will be involved in the experiment in both sites. In both communities, youths will be organized and trained on Bhungroo and solar-based drip irrigation systems. At least 60 farmers (30 at each site) will directly be involved in the demonstration. Focus group discussion with men and women farmers will be conducted to generate data on SI indicators in the social domain and farmers’ views about the irrigation system in general.  Analysis of the economic feasibility of solar-powered drip irrigation system will be based on data generated in the 2019/2020 trials; combined with data from the 2012/2021 trials. Cost- benefit analysis and/or marginal  rate of return will be used understand the economic feasibility of the irrigation sytem for smallholder  farmers in the study area. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **5. Data to be collected and uploaded on Dataverse** | | | | | | | | | | **Responsibility** | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | |  | | |
| * Yield (kg/ha)] at each harvest * Irrigation quantity applied and frequency * Fertilizer (type, quantity) * The labor involved * Cost of other inputs such as seed, pesticide and fertilizers (to be used for economic analysis) * Cost of drip kits, solar panels, Bhungroo (used for economic analysis in year 2) * Soil analysis (OC, N, P, K) | | | | | | | | | | IWMI | | |
|  | | | | | | | | | | | | |
| **6. Milestones** | | | | | | | | | | | | |
| **Deliverables** | | | | | **Means of verification** | | | | **End date** | | | |
| 6.1 Data on technical and agronomic performance of Bhungroo and solar-based drip irrigation system | | | | | Dataverse | | | | June 2021 | | | |
| 6.2 Report on the performance of Bhungroo and solar-based drip irrigation in the dry season | | | | | Project report to be published in CGSpace submitted | | | | July 2021 | | | |
| 6.4 Journal Paper based on findings from 2019/2020 and 2020/2021 data | | | | | Correspondence with Journal | | | | July 2021 | | | |
| 6.5 Finalization of the West Africa Handbook as a team collaboration with the co-authors | | | | | Chapter revision updates | | | | October 2020 | | | |
|  | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | |
| **Domain** | **Indicators** | | **Metric & Scale** | | | | **Approach for data collection** | | **Before intervention** | | | **After intervention** |
| 7.1 Productivity | Crop productivity | | Yield (kg/ha/season) at the field/plot level | | | | Weight measurement at harvested vegetables | |  | | |  |
| Input use efficiency | | Kg vegetable/kg nitrogen, phosphorus, potassium; input per season; kg vegetable/litre of irrigation water per season at plot level | | | | Weight measurement of nutrients at application; Volume measurement of applied water; weight measurement of harvested vegetables | |  | | |  |
| 7.2 Environmental | Soil biology | | % C; Total amount of soil carbon at the plot level | | | | Soil sampling and analysis | |  | | |  |
| Soil chemical quality | | Soil nutrient levels at plot level | | | | Soil sampling and analysis | |  | | |  |
| 7.3 Economic | Input use intensity | | Input per ha (kg of fertilizer/ha; m3 of water/ha at plot level | | | | Weight measurement of nutrients at application; Volume measurement of applied water | |  | | |  |
| Labour requirement | | Hours/ha at plot level | | | | Measurement of man-hours per activity | |  | | |  |
| 7.4 Social | Gender equity | | Rating of technologies by gender-friendliness at household level | | | | Interviews | |  | | |  |
| 7.5 Human | Nutrition | | Protein production (g/ha); micro-nutrient production (g/ha) at plot level | | | | Sampling and laboratory analysis | |  | | |  |
|  | Food security | | Food production (calories/ha) at plot level) | | | | Sampling and laboratory analysis | |  | | |  |
|  | | | | | | | | | | | | |
| **8. How will scaling be achieved?** | | | | | | | | | | | | |
| Scaling will be achieved in tangent with the proposed activities for outcome 3 (GH3211-21) considering both local level system scaling activities through series of stakeholder engagement. This will include but not limited to:   * Organizing stakeholder meetings with farmers and extension officers on the results of the trials and the preferred water lifting and application methods during the dry season; * Sharing research results and engaging with potential scaling partners such as regional offices of Ministry of Food & Agriculture (MoFA) and GIDA (Ghana Irrigation Development Authority), the Agriculture Sector Working Group (ASWG) ; * Linking AR’s irrigation technology and pilots with relevant multi-stakeholder dialogues/platforms to integrate the scaling into the platforms’ agendas and to facilitate the systemic changes and capacity to enhance the scaling of irrigation technologies and water solutions   Developing and using fact sheets, workshops, policy briefs, as well as scientific papers to communicate to the wider public actors, practitioners and relevant stakeholders. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **9. How are the activities in this protocol linked to those of others?** | | | | | | | | | | | | |
| This sub-activity experiment is linked to other work conducted by IWMI on water use under farmer-led irrigation In addition, it is linked to sub-activities planned by the World Vegetable Centre under GH11.15-21 and GH1116-21. And by STEPRI on policy and institutional analysis. The outcomes of this research will help to disseminate irrigated vegetable production in the Upper East Region of Ghana and other similar areas in Ghana and beyond. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **10. Custom indicators** | | | | | | | | | | | | |
| * Number of demonstrations established * Number of farmers trained * Number of field days organized * Number of meetings/workshops attended * Number of project reports produced   Number of 1 journal article submitted/published | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **11. Impact-based summary matrix** | | | | | | | | | | | | |
| * to irrigation include, but not limited to, under-developed irrigation value chains and capacities, under-developed irrigation supply chain, limited access to finance, energy, knowledge services to invest in irrigation, and weak input and output market linkages;   11.2 Who is your target audience, e.g. extension agents, farmers, or policy makers?  The most important audience include small-scale farmers, women and youth involving in farming, extension and development agents, policy makers and private sector who are working on irrigation and solar-powered products. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **12. Budget Line** | | | | | | **IWMI** | | | | | | |
| Personnel | | | | | | 74,500 | | | | | | |
| Services | | | | | | 31,904 | | | | | | |
| Supplies | | | | | | 3,276 | | | | | | |
| Capital | | | | | |  | | | | | | |
| Travel | | | | | | 6,700 | | | | | | |
| Overhead | | | | | | 18,620 | | | | | | |
| **Total** | | | | | | **135,000** | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2020** | | | | **2021** | | | | | | | |
| **Year/ Month** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Finalization of the West Africa Handbook with the co-authors |  |  |  |  |  |  |  |  |  |  |  |  |
| Farmer engagement |  |  |  |  |  |  |  |  |  |  |  |  |
| Training |  |  |  |  |  |  |  |  |  |  |  |  |
| Field Demonstration and agronomic evaluation and reporting |  |  |  |  |  |  |  |  |  |  |  |  |
| Assessment of Economic performance and reporting |  |  |  |  |  |  |  |  |  |  |  |  |
| Preparation of journal paper |  |  |  |  |  |  |  |  |  |  |  |  |

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| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Planned work** | | | | | | | | | | | | | | | | *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | **2020 Africa RISING West Africa Activity Protocol: Outcome 1: GH1411-20** | | | | | | | | | | | | | | | | Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | | a. Output 1.4 | | | Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated into capacity development (and used in outcomes 4 and 5). | | | | | | | | | | | | | b. Activity 1.4.1 | | | Generate technology extrapolation domains in West Africa. | | | | | | | | | | | | | c. Sub-activity GH1411-20 | | | Produce regionally relevant extrapolation domain maps for validated integrated technology packages. | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | d. Research team | | | | | | | | | | | | | | | | Name | | | | | | Institution | | | Role | | | | | | | Francis Muthoni | | | | | | IITA | | | Lead investigator on GIS and development of extrapolation domain maps | | | | | | | Abdul Rahman Nurudeen | | | | | | IITA | | | Cereal agronomy and plant nutrition support | | | | | | | Bekele Kotu | | | | | | IITA | | | Economic analysis | | | | | | | Fred Kizito | | | | | | IITA | | | Land and water management support | | | | | | | Winfred Atiah | | | | | | KNUST | | | Agro-meteorology and data analysis support | | | | | | | Benedict Ebito Boyubie | | | | | | IITA | | | Developing data collection tools, training of the research team on Feed the Future indicators and supporting data collection to track output level and Feed the future indicators,  Ensuring data upload on Dataverse | | | | | | | Gundula Fisher | | | | | |  | | | Gender Analysis | | | | | | | Jimah Kipo | | | | | |  | | | Gender Analysis | | | | | | |  | | | | | | | | | | | | | | | | e. Student(s) | | | | | | | | | | | | | | | | Name | | | | | Institute | | | | | | Degree | Start | | End | | Vacancy | | | | | KNUST | | | | | | MSc | 2020 | | 2021 | |  | | | | | | | | | | | | | | | | f. Location(s) | Northern (Tingoli, Cheyohi no. 2, Doku, Tibali), Upper East (Samboligo, Nyangua, Gia, Bonia), Upper West (Zanko, Guo, Goli, Goriyiri) regions | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | g. Start | June 2019 | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | h. End | April 2021 | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | Sustainable intensification technologies are suited to specific biophysical and socio-economic contexts. Technologies validated at a location should be suitable for scaling to other places with relatively similar biophysical and socio-economic conditions. Identification of areas with relatively similar conditions or outcomes to that observed in technology trial sites is one of the essential components of successful scaling out. Biophysical conditions and crop yields obtained from trial sites with good performance of technological packages will be utilized as reference for mapping other potentially suitable sites in the West Africa region. Maps on technology recommendation domains will guide development partners and extension agencies to scale-out technologies to relevant context, thus reducing the risk of failure for Africa RISING validated technologies. Since 2016, on-farm trials were conducted to validate bundles of technologies. The trial identified the best-bet combinations of groundnut spacing and fertilizer rates that produce the highest yields in Northern Ghana. Moreover, on-farm trials identified the effect of the cowpea living mulch (CPLM) planted at different times on the maize yields and soil properties and weed biomass. The gridded data on climate, soil physical and chemical properties were obtained, processed, and archived in a geodatabase. Moreover, areas experiencing significant positive and negative climatic trends (rainfall, minimum and maximum temperature) were identified from remote sensing data. The proposed activity will utilize the existing agronomic data and knowledge and remote sensing layers, to map the technology extrapolation domains. Maps on the Extrapolation Suitability Index (ESI, Muthoni 2019[[4]](#footnote-4)) will be generated for each technology package. The onset, end and length of the rain season determine the crop calendar activities such as timing of planting and the choice of crop varieties for planting (early, medium, or late maturity). Information of trends of the onset of It can help farmers improve their decision-making about the selection of crop types and varieties. Informed farmers can also reduce the risks and costs related to the re-sowing or re-planting process. Recent analysis gauge data reported a tendency of the rain season to start earlier in Tamale, Wa and Yendi (Gbangou et al 2019[[5]](#footnote-5)). There are few gauge stations with long term data. Information generated from few stations is used to guide agro-advisory over large area. Satellite derived rainfall can complement the sparse gauge network to produce spatially explicit layers representing the onset, cessation, and length of the rain season. Maps for the onset and cessation of rain season for the last 40 year will be generated from satellite estimates of daily rainfall. These maps will be compared with convectional farmer knowledge on the start and end of the rain season. Moreover, the trends and inter-annual variability of the onset and cessation of the rainfall seasons will be generated. Maps on the onset and cessation of the rain season will be input to the generation of the technology extrapolation domains. | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | **2. Objectives** | | | | | | | | | | | | | | | | 2.1 To identify where the validated groundnut spacing, maize leaf stripping and CPLM technology packages can be extrapolated with the lowest potential risk of failure in Ghana. | | | | | | | | | | | | | | | | 2.2 To map trends and variability of the onset, end, and the length of the rain season in northern Ghana | | | | | | | | | | | | | | | | 2.3 To validate if the remote sensing estimates of the onset and the end of the rainy season agree with farmers' knowledge? | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | **3. Research questions** | | | | | | | | | | | | | | | | 3.1 What are biophysical factors that most limit the performance of selected technological packages in their trial sites in Ghana? | | | | | | | | | | | | | | | | 3.2 Where in Ghana can the validated groundnut spacing, maize leaf stripping and CPLM technology packages can be extrapolated with lowest potential risk of failure? | | | | | | | | | | | | | | | | 3.3 Are there significant trends of the onset, end, and the length of the rainy season in Northern Ghana? | | | | | | | | | | | | | | | | 3.4 Does the remote sensing estimates of the start and end of the rain season agree with farmer knowledge? | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size)** | | | | | | | | | | | | | | | | Will work with agronomists and socio-economists to identify the best-bet recommendations from the on-farm trials of groundnut spacing, maize leaf stripping, and the effect of four levels of cowpea living mulch on grain yield of maize (see details in sub-activity GH1111-20). The technology extrapolation domain (TEDs) will be developed using gridded data of biophysical parameters to identify suitable areas for scaling out the validated technologies. TEDs will be developed using the Extrapolation Suitability Index (ESI, Muthoni et al 20191) method. The onset, cessation, and the length of the rainy season for the last four decades will be determined using the percentage mean cumulative rainfall amount and the number of rainy days from the gridded daily CHIRPS-2 data. The slope and significance of the trend for the three variables will be calculated using the Sen’s slope and the Mann-Kendall test. | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | **5. Data to be collected and uploaded on Dataverse** | | | | | | | | | | | | | **Responsibility/Institute** | | | **Is the collected data part of a multi-year experiment/trial?** **Yes** | | | | | | | | | | | | |  | | | 5.1 Remote sensing layers | | | | | | | | | | | | | IITA | | | 5.2 Farmer knowledge on the onset of the rainy season | | | | | | | | | | | | | KNUST | | | 5.3 Weather station data (rainfall) | | | | | | | | | | | | | KNUST | | |  | | | | | | | | | | | | | | | | **6. Milestones** | | | | | | | | | | | | | | | | Deliverables | | | | | | | Means of verification | | | | | Delivery date | | | | 6.1 Maps of technology extrapolation domain and most limiting covariates | | | | | | | Compendium of maps | | | | | Mar. 2021 | | | | 6.2 Draft manuscript on TEDs | | | | | | | #1 Manuscript drafted | | | | | Apr. 2021 | | | | 6.3 Dates of start, end, and length of rainy season mapped | | | | | | | Maps published | | | | | Apr. 2021 | | | | 6.4 Trend and variability of start, end and length of rainy season mapped | | | | | | | Maps published | | | | | Apr. 2021 | | | |  | | | | | | | | | | | | | | | | 7. Sustainable intensification indicators | | | | | | | | | | | | | | | | Domain | | Indicator | | | | | | Metrics | | | | | | | | N/A for sub-activity | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | 8. How will scaling be achieved? | | | | | | | | | | | | | | | | Maps generated from this activity will be a decision support tool to guide better scaling out of validated technologies. Maps will be shared with extension and development agencies to guide evidence-based scaling out of technology packages. | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | This activity is linked to sub-activity GH1111-20: Cowpea living mulch effect on weed control, soil properties, and maize yield. | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | 10. Custom indicators: | | | | | | | | | | | | | | | | 10.1 Project semi-annual report  10.2 Geodatabase  10.3 Journal publication | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | **11. Impact-based summary matrix** | | | | | | | | | | | | | | | | 11.1 What is the development challenge you are addressing?  Food insecurity and natural resource management | | | | | | | | | | | | | | | | 11.2 Who is your target audience?  The extension and development agents involved in scaling-out of technologies. | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | **12. Budget (US$)** | | | |  | | | | | |  | | |  | | | **Budget Line** | | | | **IITA** | | | | | | **KNUST** | | |  | | | Personnel | | | | 32901 | | | | | | 20001 | | |  | | | Services | | | |  | | | | | |  | | |  | | | Supplies | | | | 13002 | | | | | |  | | |  | | | Capital | | | |  | | | | | |  | | |  | | | Travel | | | | 65123 | | | | | |  | | |  | |   13. Gantt Chart   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Year/ Month** | **2020** | | | | | | | | **2021** | | | | | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | | Determine Best-bet treatments & reference sites |  |  |  |  |  |  |  |  |  |  |  |  | | Remote sensing data processing |  |  |  |  |  |  |  |  |  |  |  |  | | Generate ESI maps |  |  |  |  |  |  |  |  |  |  |  |  | | Manuscript write-up |  |  |  |  |  |  |  |  |  |  |  |  | | Communication and dissemination |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Planned Work** | | | | | | | | | | | | | | | | | *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | | **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH1412-20** | | | | | | | | | | | | | | | | | Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | | | a. Output 1.1 | | | | | Tools (including ICT-based) and approaches for disseminating recommendations in relation to the above research products, integrated into capacity development | | | | | | | | | | | | b. Activity 1.4.1 | | | | | Generate technology extrapolation domains in West Africa. | | | | | | | | | | | | c. Sub-activity GH1412-20 | | | | | Identify the sustainable agricultural intensification technologies and household characteristics that determine the maize grain yields at the different technology extrapolation domains. | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | d. Research team | | | | | | | | | | | | | | | | | Name | | Institution | | | | | | | | Role | | | | | | | Francis Muthoni | | IITA | | | | | | | | Spatial analysis and activity leader | | | | | | | Bekele Kotu | | IITA | | | | | | | | Economic analysis | | | | | | | Shaibu Mellon Bedi | | Center for Development Research, ZEF | | | | | | | | Economic analysis | | | | | | | Zhe Guo | | IFPRI | | | | | | | | Spatial analysis | | | | | | | Carlo Azzarri | | IFPRI | | | | | | | | Economic analysis | | | | | | | Jeroen Groot | | WUR | | | | | | | | Farm typologies | | | | | | | Gundula Fisher | |  | | | | | | | | Gender Analysis | | | | | | | Jimah Kipo | |  | | | | | | | | Gender Analysis | | | | | | |  | | | | | | | | | | | | | | | | | e. Student(s) | | | | | | | | | | | | | | | | | Name | | | | | | Institute | | | | | Degree | | Start | | End | |  | | | | | | | | | | | | | | | | | f. Location(s) | Northern (Tingoli, Cheyohi no. 2, Doku, Tibali), Upper East (Samboligo, Nyangua, Gia, Bonia), Upper West (Zanko, Guo, Goli, Goriyiri) regions | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | g. Start | May 2020 | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | h. End | March 2021 | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | Sustainable intensification technologies (SAI) are suited to specific biophysical and socio-economic context. The low adoption of SAI technologies in smallholder farming systems in Ghana is partly due to poor spatial targeting. Maps of technology extrapolation domains (TEDs) that encompass non-contiguous zones with relatively similar agricultural and investment potential can improve targeting of SAI technologies. Crop yields or responses to management practices are relatively similar within a specific TED. TEDs are utilized to target technologies to their proper context, thus reducing the probability of failure. Information on factors that determine variations in maize yields at different TEDs in Ghana is lacking. Several TEDs have been mapped in Ghana from gridded biophysical layers. However, agricultural investments and policies are formulated primarily based on administration units. There is a knowledge gap on which bundles of SAI technologies are suitable for specific TEDs. Moreover, household characteristics such as resource endowments, level of education, and influence the adoption of SAI technologies. Management practices and socio-economic factors that drive the variability of maize yields at fine-scale TEDs in Northern Ghana will be identified. A machine learning algorithm will be utilized to analyze data in the GARBES database to identify the determinants of maize yields at different TEDs. The information generated from this study will help in targeting SAI technologies in a proper context. | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | **2. Objectives** | | | | | | | | | | | | | | | | | 2.1 To develop fine-scale agro-climatic zones representing (TEDs) for in Ghana based on long-term gridded agro-climatic data | | | | | | | | | | | | | | | | | 2.1 To identify the significant SAI practices and socio-economic factors that explain the variance of maize yields at different TEDs in Ghana | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | **3. Research questions** | | | | | | | | | | | | | | | | | 3.1 What are the SAI practices and socio-economic factors that significantly explain the variation of maize yields at different TEDs in Ghana? | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size)** | | | | | | | | | | | | | | | | | 4.1 GARBES data will be analyzed using a conditional Inference Tree (ctree) algorithm to extract knowledge on which bundles of SAI technologies and household characteristics significantly drive variability in maize grain yields at different TEDs in Ghana. | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | **5. Data to be collected and uploaded on Dataverse** | | | | | | | | | | | | | | **Responsibility/Institute** | | | **Is the collected data part of a multi-year experiment/trial? No** | | | | | | | | | | | | | |  | | |  | | | | | | | | | | | | | | | | | **6. Milestones** | | | | | | | | | | | | | | | | | Deliverables | | | | | | | Means of verification | | | | | | Delivery date | | | | 6.1 Technology extrapolation domains | | | | | | | Maps in Dataverse | | | | | | Mar. 2021 | | | | 6.2 Manuscript on determinants of maize yields at different TEDs | | | | | | | Confirmation from journal of manuscript submission | | | | | | Mar. 2021 | | | |  | | | | | | | | | | | | | | | | | 7. Sustainable intensification indicators | | | | | | | | | | | | | | | | | Domain | | | Indicator | | | | | | Metrics | | | | | | | | N/A for sub-activity | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | 8. How will scaling be achieved? | | | | | | | | | | | | | | | | | Maps generated from this activity will identify which identify spatial typologies where specific sustainable intensification technologies are to targeted while also considering the socio-economic context of farmers | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | This activity is linked to sub-activity GH4112-20: Evaluate the impact of sustainable intensification practices on household welfare, poverty, perceived shock, the environment, and food and nutrition security in northern Ghana. | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | 10. Custom indicators : | | | | | | | | | | | | | | | | | 10.1 Project semi-annual report  10.2 Geodatabase  10.3 Journal publication | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | **11. Impact-based summary matrix** | | | | | | | | | | | | | | | | | 11.1 What is the development challenge you are addressing?  Food insecurity and natural resource management | | | | | | | | | | | | | | | | | 11.2 Who is your target audience?  The extension and development agents involved in scaling-out of technologies. | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | 12. | | | | | | | | | | | | | | | | | **Budget Line** | | | | **IITA** | | | | **IFPRI** | | | | **WUR** | | | | | Personnel | | | | 45001 | | | |  | | | |  | | | | | Services | | | | 50002 | | | |  | | | |  | | | | | Supplies | | | |  | | | |  | | | |  | | | |   **13. Gantt Chart**   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Year/ Month** | **2020** | | | | | | | | **2021** | | | | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | | GARBES data Cleaning |  |  |  |  |  |  |  |  |  |  |  | | Generate fine ACZ as TEDs |  |  |  |  |  |  |  |  |  |  |  | | Analysis with machine learning algorithm |  |  |  |  |  |  |  |  |  |  |  | | Manuscript write-up |  |  |  |  |  |  |  |  |  |  |  | | Communication & dissemination |  |  |  |  |  |  |  |  |  |  |  | | | | | | | | | | | | | | | | |
| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 2: GH2121-20** | | | | | | | | | | | | | | | |
| Outcome 2: More farmers and farm families in the intervention communities are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition | | | | | | | | | | | | | | | |
| a. Output 2.1 | | | | Improved technologies, practices and habits to increase production and consumption of diverse and more nutritious food by farm families, especially by women and children are developed | | | | | | | | | | | |
| b. Activity 2.1.2 | | | | Train farm families, especially women, to produce and consume diverse and more nutritious food | | | | | | | | | | | |
| c. Sub-activity GH2121-20 | | | | Container gardening training combined with nutrition education for increased vegetable consumption | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | |  | | | | |  | | | | | | |
| Name | | | | Institution | | | | | Role | | | | | | |
| Mahama Saaka | | | | UDS-Dept. Nutritional Sciences | | | | | Sub-activity lead | | | | | | |
| Clement Kubuga | | | | UDS-Dept. Nutritional Sciences | | | | | Training and supervision farmer groups on the use of container vegetable gardening | | | | | | |
| Jean-Baptiste Tignegre | | | | WorldVeg | | | | | Setting up the nutrient-dense vegetable gardens in selected communities | | | | | | |
| Fauzia Sadick | | | | Women in Agric Development (WIAD) | | | | | Mobilization of community interest groups (e.g. women’s groups) | | | | | | |
| Benedict Ebito Boyubie | | | | IITA | | | | | Development of data collection tools, training of the research team on Feed the Future indicators and supporting data collection to track output level and Feed the future indicators;  Ensuring data upload on Dataverse | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | Institute | | | | | | Degree | | Start | | | End | | |
| NIL | |  | | | | | |  | |  | | |  | | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | | | 25 communities in 5 districts (Savelugu, Tolon, Wa West, Nadowli and Kassena-Nankana) of northern Ghana (This expands beyond the 12 Africa RISING communities) | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | | July 2018 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | | June 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| In July 2018 and in response to reports that farmers were not patronizing a vitamin A fortified variety of tomatoes that were being promoted by World Vege in the Upper East, a sub-activity titled “nutrition educational campaign on vegetable consumption” was started. Due to the low patronage, the production of this tomato variety was discontinued because the farmers complained the variety was not attractive to consumers and therefore had no market value. However, nutrition education on the nutritional value and preparation of vegetables was carried out on radio to raise awareness of the nutritional value of vegetables generally. Our formative research finding showed that the availability and/or own production of fruits and vegetables was the main factor that makes it easier for households to consume fruit and vegetables**.** The program implication of this finding was that home gardens will contribute to improving the availability of vitamin-rich fruits and vegetables. This warranted a modification of this sub-activity in September 2019 where the concept of container gardening technology was introduced to allow households produce their own vegetables even in dry season when access to water is problematic. Model vegetable container gardens have been set up in 18 communities. However, individual farmer adoption of the technology is in the initial stages and will have to be promoted vigorously for a longer period.  In most households of Northern Ghana, there is an inadequate intake of micro-nutrients partly due to lack of access to a variety of foods, and intake of animal source foods is low. The quality of a child’s diet is a key determinant of optimal growth, development and health. Poor nutrition not only retards growth and development but also increases children’s risk of developing chronic diseases such as obesity, increased cholesterol levels and hypertension later in life (Berenson *et al*., 1998[[6]](#footnote-6); Schneider *et al*., 2007[[7]](#footnote-7); Skinner *et al.[[8]](#footnote-8)*, 2004).  Micronutrient deficiencies may be addressed by increasing the availability of, access to, and ultimately consumption of foods that are rich sources of micronutrients. A food-based approach that could help reduce micronutrient deficiencies by providing nutrient-rich foods is home gardening (Shisanya S.O., Hendriks S.H., 2011[[9]](#footnote-9); Berti P.R., Krasavec J., Fitzgerald S., 2004[[10]](#footnote-10); Holmer R.J., 2011[[11]](#footnote-11); Keatinge J.D.H. *et al*., 2011[[12]](#footnote-12)). It is further argued that vegetable gardening enables women to have greater authority over the quality of the family diet (Ruel, M.T., Levin C.E., 2001[[13]](#footnote-13)). In addition, the potential use of household wastewater for irrigation and household organic wastes for compost provides opportunities to make efficient use of limited resources and close broken nutrient cycles and this is of benefit to the environment and can represent a sustainable system.  However, poor diets and inadequate food intake are not always the result of a lack of food or money to buy food. People must have some knowledge of nutrition: the most important information is what kinds of food to eat and how to prepare the food in the right quantities and mixes and in a way that is safe and clean for children's healthy growth and development. Therefore, concurrent nutrition education and home vegetable production are key elements of this sub-activity.  For poor households, vegetables and fruits are often the only sources of micronutrients in the family diet. Homestead production of fruits and vegetables provides the household with direct access to important nutrients that may not be readily available or within their economic reach.  A sustainable means of producing the basic essential food such as vegetables is a requirement for preventing micronutrient deficiencies. A home garden can supply a family with substantial quantities of a variety of foods all year round and a source of family income. Home gardening, therefore, has economic and nutritional merit but which most households are not taking advantage of due to some constraints including lack land space and water availability.  Therefore, this study seeks to evaluate whether home container gardening would be a good means to improve household food and nutrition security. The intervention focuses on introducing improved (open-pollinated) nutrient-rich vegetable varieties suitable for growing in a home garden and for which seeds are locally available. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 Train rural households in container vegetable gardening techniques including container garden establishment, planting bed preparation, compost making and pest and disease management  2.2 To deliver nutrition education on processing and preservation techniques to preserve the nutritional content of vegetables during cooking, preparation of nutritious and safe meals. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 Can training on homestead gardening improves the dietary quality and household food security and nutrition in rural households in Northern Ghana? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| 4.1 Demographic, socio-economic and home garden information will be collected during household interviews using a structured questionnaire.  Household food intake will be assessed by using a semi-quantitative method based on recall of foods consumed by the household during the 24 hours preceding the survey from the household member who prepared the previous day’s meals.  The main independent variable will be the production and consumption of nutrient-dense foods.  Household food security will be assessed by using food consumption score (FCS) and individual and household dietary diversity. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | Responsibility/Institute | | | |
| Is the collected data part of a multi-year experiment/trial? | | | | | | | | | | | | Yes | | | |
| 5.1 Data on number of households trained, vegetable production and utilization will be collected regularly through monitoring. Further, beneficiary awareness of the nutritional values and preparation of fruits and vegetables, dietary diversity will be assessed at end of activity. | | | | | | | | | | | | Mahama Saaka/UDS | | | |
| 5.2 Monitoring data (Vegetable production figures and established number of vegetable gardens) | | | | | | | | | | | | Jean-Baptiste Tignegre/WorldVeg | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | | Date of Delivery | | | |
| 6.1 Number of households trained in container gardening | | | | | | Training report | | | | | | March 2021 | | | |
| 6.2 Knowledge and dietary practices regarding fruits and vegetables | | | | | | Technical evaluation report of intervention | | | | | | August 2021 | | | |
| 6.3 An article on improving household diet diversity through promotion of vegetable container gardening | | | | | | Article available online | | | | | | December 2021 | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | | |
| **Domain** | **Indicators** | | | | **Metric & Scale** | | **Approach**  **Used in Data Collection** | | | | **Before Intervention** | | | **After Intervention** | |
| 7.5 Human | Nutrition | | | | Minimum dietary diversity of children under 5 years at household level  Nutritional status (stunting, wasting and underweight) of children under 5 years at household level | | Household nutrition survey  Anthropometric assessmen | | | | 25.7 %  25.1 % stunted, 10.6 % wasted and 18.5 underweight | | |  | |
|  | Capacity to experiment | | | | Number of new practices tested by women of childbearing age | | Routine monitoring | | | | Proportion of households having homestead container gardens = 0 | | |  | |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| The results of nutrition interventions may guide stakeholders including Agricultural Extension Officers and development practitioners to extend the improved technology to other communities. Furthermore, scaling up nutrition and agricultural interventions entails identifying those programs and practices of proven efficacy. Therefore, a successful outcome of this intervention study has a great potential of replication in other countries as well when the results are published. | | | | | | | | | | | | | | | |

|  |  |
| --- | --- |
| 9. How are the activities in this protocol linked to those of others? | |
| This activity has close links to Sub-activity GH1115-20 which will identify varieties of vegetable crop species with adaptation to Northern Ghana in the dry season, Sub-activity GH1116-20 which seeks to improve the capacity of vegetable farmers on vegetable gardening and post-harvest techniques.  Targeting of nutrition-specific interventions will primarily be based on the vulnerability of households to food insecurity and high prevalence of undernutrition*.* Activities will be implemented in line with the Africa RISING overall strategic partnerships and geographical targeting ensuring convergence of nutrition interventions with other interventions and stakeholder activities (including livestock and crops) to focus on the same locations with complementary services in order to increase the impact of each other's actions . | |
|  | |
| 10. Custom indicators   1. Number of farmers trained in home gardening at household level 2. Number of households that have successfully adopted container home gardening technology 3. Income from the sale of garden produce 4. Vegetable production expressed in kilograms per household member per year | |
|  | |
| 11. Impact-based summary matrix | |
| 11.1 What is the development challenge you are addressing? Under-nutrition effects on human capital resource | |
| 11.2 Who is your target audience? e.g. extension agents, farmers, or policymakers: Farm families | |
|  | |
| 12. Budget (US$) | |
| **Budget Line** | **UDS** |
| Personnel | 9,000 |
| Services | 7,000 |
| Supplies | 5,500 |
| Travel | 5,500 |
| Overhead (15%) | 4,050 |
| **Total** | **31,050** |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quarter | Quarter 3 (2020) | | Quarter 4 (2020) | | | Quarter 1  (2021) | | | Quarter 2 (2021) | | | Quarter 3 (2021) | | |
| Month | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **Sub-activity GH2121-20** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Nutrition education on nutritional value and processing fruits and vegetables to farmer groups |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Re-train women farmer groups on container vegetable gardening technology |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Baseline assessment of container garden production activities |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Supervision of field activities |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Impact evaluation of intervention |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Manuscript preparation and publication |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned Work** | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 2: GH2122-20** | | | | | | | | | | | | |
| Outcome 2: More farmers and farm families in the intervention communities are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition | | | | | | | | | | | | |
| a. Output 2.1 | | Improved technologies, practices and habits to increase production and consumption of diverse and more nutritious food by farm families, especially by women and children are developed | | | | | | | | | | |
| b. Activity 2.1.2 | | Train farm families, especially women, to produce and consume diverse and more nutritious food | | | | | | | | | | |
| c. Sub-activity GH2122-20 | | Engaging Men to Increase Support for Optimal Child Feeding Practices Using Care Group Approach/Model | | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | |  | | | | |  | | | | | |
| Name | | Institution | | | | | Role | | | | | |
| Mahama Saaka | | UDS- Community Nutrition | | | | | Sub-activity leader | | | | | |
| Chrisantus Daari | | Ghana Health Service | | | | | Training of men’s groups, data collection and compilation of monthly reports on activities | | | | | |
| Kofi Evam Glover | | UDS- Community Health Dept. | | | | | Social scientist to assist with the conduct of a qualitative formative study on gender issues on nutrition at community level | | | | | |
| Eric Nang | | Ghana Health Service | | | | | Training of men’s groups, data collection and compilation of monthly reports on activities | | | | | |
| Khadija Wemah | | Ghana Health Service | | | | | Monitoring of subdistrict field activities including delivery of nutrition education, men’s group meetings and home visits | | | | | |
| Benedict Ebito Boyubie | | IITA | | | | | Development of data collection tools, training of the research team on Feed the Future indicators and supporting data collection to track output level and Feed the future indicators.  Ensuring data upload on Dataverse | | | | | |
|  | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | |
| Name | | Institute | | | | | Degree | | Start | | End | |
|  | |  | | | | |  | |  | |  | |
|  | | | | | | | | | | | | |
| f. Location(s) | | 25 communities in 5 districts (Savelugu, Tolon, Wa West, Nadowli and Kassena-Nankana) of northern Ghana (This expands beyond the 12 Africa RISING communities | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | | July 2018 | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| This sub-activity started in July 2018 but was revised last year to include the participation of men in the care of children. Men’s groups were formed and inaugurated in 20 communities. Monthly care group meetings for both men’s and women’s groups commenced in October 2019. However, the meetings had to be suspended in March 2020 because of COVID-19 demand for social distance. Over the years, mothers have been the focus of nutrition education and this has led to a better understanding of nutrition issues among women than their male counterparts. In practice, when it comes to decision making regarding improving optimal feeding of children, the support of men cannot be over-emphasized. In Ghana, most community programs seeking to improve the well-being of women and children target mothers and their children with little attention to fathers as key influencers. There is great potential for fathers to make a difference in the rate of the infant feeding practices, but they need information in order to make a difference (Kenosi *et al*., 2011)[[14]](#footnote-14) (Tohotoa *et al*., 2009)[[15]](#footnote-15). Engagement of fathers by educating them on infant and young child nutrition including breastfeeding through men’s group activities may greatly improve infant feeding and health behavior (Sloand *et al.*, 2009)[[16]](#footnote-16) (Matovu *et al*., 2008)[[17]](#footnote-17) because they play a critical role in providing instrumental and emotional support to mothers and children. Interventions that involve men as agents of positive change in support of their partners to adequately feed their families may greatly improve infant feeding and health behavior (Sloand *et al.*, 2009)19 but the evidence is lacking in Ghana and therefore warrants more research in this area. This is an innovative training designed to provide nutrition messages through peer group mothers and to leverage the role that fathers in decision-making related to health and nutrition behaviors. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 To assess men’s willingness to be engaged in discussing and promoting infant feeding in Northern Ghana | | | | | | | | | | | | |
| 2.2 To determine the influence and effect of fathers’ participation in nutrition education sessions on child feeding practices and on the nutritional status of their children under three years | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 Can men engagement in nutrition education at the community levelimprove child feeding practices and child nutrition? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| A cluster non-randomized-controlled trial will be used to assess the effectiveness of engaging men in nutrition education on child feeding practices and nutritional status of children. This will entail carrying out pre-post cross-sectional surveys. The sample size will be calculated that will be adequate with 80 % power to detect an effect size of 20 % at 95 % confidence level. Households with men participating in community nutrition education activities will constitute the intervention group whilst the comparison group will comprise households not involving men in such activities. At the cluster level, a sample size of 15 households with a male partner/caretaker and children under three years of age will be systematically selected across the 25 Africa RISING intervention communities. A difference-in-differences analysis will be used to calculate intervention effects. Adjusted odds ratios (AORs) and 95% confidence intervals (95% CI) of associated factors with the key outcome measures will also be estimated. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | Responsibility/Institute | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | |  | | | | | |
| 5.1 Study data (Monitoring and end line survey) | | | | | | | Mahama Saaka/UDS | | | | | |
| 5.2 Monitoring data (Care group on-going functionality data) | | | | | | | Mahama Saaka/UDS | | | | | |
|  | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | |
| Deliverables | | | | | Means of verification | | | | | Date of delivery | | |
| 6.1 Impact Evaluation report of intervention | | | | | A link to the Impact evaluation report on intervention will be shared in the semi-annual report to the donor. | | | | | September 2021 | | |
| 6.2 A paper on Using men engagement in nutrition educationto improve child feeding practices/nutrition | | | | | Online publication | | | | | December 2021 | | |
|  | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | |
| **Domain** | **Indicators** | | **Metric & Scale** | | | **Approach**  **Used in Data Collection** | | **Before Intervention** | | | | **After Intervention** |
| 7.1 Productivity | Not applicable | |  | | |  | |  | | | |  |
| 7.2 Environmental | Not applicable | |  | | |  | |  | | | |  |
| 7.3 Economic | Not applicable | |  | | |  | |  | | | |  |
| 7.4 Social | Not applicable | |  | | |  | |  | | | |  |
| 7.5 Human | Nutrition | | Minimum dietary diversity of children under 5 years at household level  Nutritional status (stunting, wasting and underweight) of children under 5 years at household level | | | Household nutrition survey  Anthropometric assessment | | 25.7 %  25.1 % stunted, 10.6 % wasted and 18.5 underweight | | | |  |
|  | Capacity to experiment | | Number of new practices tested by women of childbearing age | | | Household survey | | Level of male involvement in promoting infant feeding (35 %) | | | |  |
|  | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | |
| The intervention is being carried out in strong collaboration with Ghana Health Service staff who will be able to extend the activities to other communities where they operate. Advocacy campaign using the power of radio will also greatly facilitate the scale-up of this intervention geographically because radio reaches out to the public more effectively and efficiently. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| Activities will be implemented in line with the Africa RISING overall strategic partnerships and geographical targeting ensuring convergence of nutrition interventions with other interventions and stakeholder activities that seek to deliver useful messages to community groups | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 10. Custom indicators  A published paper on the impact of the engagement of men on infant and young child nutrition education and nutrition practices | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing? Under-nutrition effects on human capital resources | | | | | | | | | | | | |
| 11.2 Who is your target audience? Men’s groups, community opinion leaders including chiefs | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | |
| Budget Line | | | | **UDS** | | | | | | | | |
| Personnel | | | | 4,000 | | | | | | | | |
| Services | | | | 3,000 | | | | | | | | |
| Supplies | | | | 3,500 | | | | | | | | |
| Travel | | | | 4,200 | | | | | | | | |
| Overhead (15%) | | | | 2,130 | | | | | | | | |
| **Total** | | | | **16,330** | | | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quarter | Quarter 3 (2020) | | Quarter 4 (2020) | | | Quarter 1  (2021) | | | Quarter 2 (2021) | | | Quarter 3 (2021) | | |
| Month | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Monthly care group meetings with men and women |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Training of more men’s groups |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Process evaluation of men’s involvement in child feeding |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Holding community durbars and special fathers’ days |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Supervision of field activities |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Impact evaluation of intervention |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Manuscript preparation and publication |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 2: GH2211-20** | | | | | | | | | | | | | | |
| Outcome 2: More farmers and farm families are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition. | | | | | | | | | | | | | | |
| Output 2.2 | | | Postharvest technologies and practices to provide options for the food and feed sectors are tested and disseminated to farmers, through researchers, extension staff, and development partners. | | | | | | | | | | | |
| b. Activity 2.2.1 | | | Introduce, evaluate, adapt and disseminate existing postharvest technologies and practices. | | | | | | | | | | | |
| c. Sub-activity GH2211-20 | | | Evaluate the threshing efficiency of different maize shellers with regards to grain quality characteristics as influenced by different varieties and harvest timing. | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **d. Research team** | | | | | | | | | | | | | | |
| Name | | | | | Institution | | | | Role | | | | | |
| Issah Sugri | | | | | CSIR-SARI | | | | Lead Investigator and coordinates all activities | | | | | |
| Mutari Abubakari | | | | | CSIR-SARI | | | | Team Member and contributes to data collection | | | | | |
| Robert K. Owusu | | | | | CSIR-SARI | | | | Data collection and analysis | | | | | |
| Kotu Bekele | | | | | IITA | | | | Socio-economic analysis | | | | | |
| Abdul-Rahman Nurudeen | | | | | IITA | | | | Team member offers agronomic support | | | | | |
| Benedict Boyubie | | | | | IITA | | | | Compilation of FtF indicators and ensuring data upload | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | | Degree | | Start | End |
| Nil | | | |  | | | | | | |  | |  |  |
|  | | | | | | | | | | | | | | |
| f. Location(s) | UER (Nyangua, Tekuru, Bonia), NR (Doku, Tibale) | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | July 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | June 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **1. Justification** | | | | | | | | | | | | | | |
| One essential component of agricultural intensification is access to agricultural mechanization (Diao et al., 2013). This involves the adoption of non-human sources of power to undertake agricultural operations such as ploughing, planting, harvesting and threshing. Farmers who have access to improved agricultural tools and powered technologies can shift from subsistence farming to more market-oriented farming, making the agricultural sector more attractive to women and rural youth. Also mechanized operations are known to improve efficiency, timely operations as well as reduce drudgery and labor cost (Fu et al., 2018; Unakıtan and Aydın, 2018). Across the world, dwindling access and high cost of farm labor remain a challenge. Nin-Pratt and McBride (2014), noted that labor costs still play a major role in Ghana’s agricultural development, thereby limiting the adoption of labor-intensive technologies even in relatively high population density areas. Another worry is that most of the manual farm operations are carried out entirely by women; a trend requiring cogent efforts to reduce the burden on women in production operations. In the view of Awasthi et al. (2017), farm activities that are time and labor intensive, monotonous, repetitive and drudgery prone are generally performed by women. Since all the operations are done manually they cause considerable physical and mental fatigue as well as health complications to these women.  This study lays emphasis on the emerging role of mechanized harvesting and threshing operations in northern Ghana, and identifies options to address their availability, cost, adoption and operational efficiencies. The crops of emphasis are maize, groundnut and soybean. These crops are among the dominant food crops in northern Ghana due to their potential contribution to income, food security and household nutrition. Both their production and value addition processes are strongly supported by the Ghana’s Government Planting for Food and Jobs Program, which commenced in 2017. Evidence shows that these crops will continue to be the important drivers of agricultural growth in northern Ghana. Consequently, commercial production of these crops has noticed ascendency across districts in northern Ghana by a number of medium to large scale entrepreneurial farmers. Certainly, timely and efficient postharvest operations have significant influence on grain quality, postharvest losses and income. Another reason is that, farmers cultivate multiple crops and therefore planting to harvesting activities may overlap. Generally, the highly efficient threshing machines are costly and inaccessible to smallholder farmers (Bello and Fabian, 2018). For instance, advanced threshers combine all harvesting, threshing, separation and cleaning operations. Different threshing machines (single-purpose or semi-mechanized, multi-purpose, and multi-crop) are available in the market, which can be manual, engine-driven, and motor-driven. Nonetheless, addressing the current challenges (access, cost and efficiency) is a shared responsibility of major actors such as producers, government and the private sector. Over the years, IITA-Africa RISING Program working in collaboration with several partners in Northern Ghana have sought to bridge some of such knowledge gaps at both the production and postharvest stages. Currently, the Program is promoting a semi-mechanized diesel powered maize shelling machines (R170A Max. Engine power: 4.95Ps, 12hr rated power 4.5Ps, Declared speed: 2600r/min, Average weight 43Kg) in the communities to improve postharvest activities.  It is worth stating that a combination of factors: material properties (variety, size of cob, grain moisture content); machine operation efficiency; physical environment, and human expertise influence threshing performance (Srison et al., 2016, Fu *et al*., 2018, Tunhaw *et al*., 2019). Some of the engineering factors that affect efficiency are the design of the power transmission shaft, selection of the prime mover, type of pulley, belt design, and selection of appropriate bearings support (Tunhaw *et al*., 2019). In the account of Fu *et al*., 2018, threshing performance such as grain losses and damage are significantly affected by contact pattern between grains and threshing components, speed of threshing cylinder, and material properties such as grain moisture content, size, mechanical strength and geometry. Contact models are constructed based on geometric structures and mechanical motions of threshing devices (Fu *et al*., 2018). Force and motion are among the important parameters of contact models in design of grain threshing devices. Therefore, manipulation of design considerations is necessary in optimizing threshing efficiency.  **References**   1. Awasthi N., Sahu A. and Singh P. 2017. Efficiency assessment of maize sheller in context of drudgery of farm women. I*nternational Journal of Science and Research 6(5): 1671-1673.* 2. Bello R.S. and Fabian C. 2018. Development and performance evaluation of a spring-loaded hand operated maize sheller with variable mechanisms. *International Journal of Engineering and Technologies. 15:44-52.* 3. Diao X., Cossar F., Houssou N. and Kolavalli S. 2014. Mechanization in Ghana: Emerging demand, and the search for alternative supply models. *Food Policy. 48: 168–181*. 4. Fu J., Chen Z., Han L.J. and Ren LQ. 2018. Review of grain threshing theory and technology. International Journal of Agriculture and Biological Engineering. 11(3): 12–20. 5. Nin-Pratt A. and McBride L. 2014. Agricultural intensification in Ghana: Evaluating the optimist’s case for a Green Revolution. Food Policy. 48 (2014) 153–167. 6. Srison W., Chuan-Udom S. Saengprachatanarak K. 2016. Effects of operating factors for an axial-flow corn shelling unit on losses and power consumption. *Agriculture and Natural Resources 50: 421-425* 7. Tunhaw M., Chuan-Udom S., Chansrakoo W. and Doungpueng K. 2019. Factors affecting shelling efficiency and grain breakage of a small maize shelling unit. *IOP Conf. Ser.: Earth and Environmental Science 301: 012011.IOP Publishing*. doi:10.1088/1755-1315/301/1/012011 8. Unakıtan G. and Aydın B. 2018. A comparison of energy use efficiency and economic analysis of wheat and sunflower production in Turkey: A case study in Thrace Region. *Energy. 149: 279–285.* | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **2. Objectives** | | | | | | | | | | | | | | |
| 2.1 To reduce postharvest losses by evaluating and promoting the use of improved, simple and efficient threshing machines for smallholders | | | | | | | | | | | | | | |
| 2.2 To evaluate the operational and economic efficiencies of different threshing machines which are appropriate for small and medium-scale growers | | | | | | | | | | | | | | |
| 2.3 Promote, demonstrate and train beneficiary farmers on factors affecting threshing performance | | | | | | | | | | | | | | |
| 2.4 Assess quality tolerance levels of maize, groundnut and soybean grain in selected local markets. | | | | | | | | | | | | | | |
| 2.5 Conduct socio-economic, benefit-cost and gender analysis of postharvest operations and threshing machines | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **3. Research questions** | | | | | | | | | | | | | | |
| 3.1 How can we improve harvesting/postharvest activities among small and medium scale farmers? | | | | | | | | | | | | | | |
| 3.2 How can we save farm-family time and energy into other productive enterprises? | | | | | | | | | | | | | | |
| 3.3 How can manual activities be reduced to make agriculture attractive and profitable to women, youth and medium-scale farmers? | | | | | | | | | | | | | | |
| 3.4 How can access to threshing machines be enhanced? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.)** | | | | | | | | | | | | | | |
| Mixed approaches involving field measurements, focus group discussions and key informant surveys are being conducted in four districts; namely: Binduri and Kassena Nankane East Municipal (KNEM) in the Upper East Region and Savelegu and Karaga Districts in the Northern Region. Binduri and Karaga Districts were selected due to the relative large proportion of farmers engaged in maize, groundnut and soybean production. The KNEM and Savelegu District have been involved in the IITA-Africa RISING Program activities since 2012. Through this partnership, the beneficiary communities were supported with semi-mechanized diesel powered maize shelling machines (R170A Max. Engine power: 4.95Ps, 12hr rated power 4.5Ps, Declared speed: 2600r/min, Average weight 43Kg) on work-and-pay basis. We study and compare the use and efficiency of these machines as well as other threshing machines and services that are available in these districts.  The field work during the 2019/2020 season, which involved a series of focus group discussions, key informant interviews and field measurements, will continue from June 2020 to June 2021. This study will make use of the peak harvest of cereals (October to December) in northern Ghana. Purposive sampling targeting farmers who essentially employ maize, soybean and groundnut threshing machines and related services is employed. The second level of randomization involves accidental interviews of farmers who are shelling their maize, groundnut or soybean at the spot. An interview guide being modified to generate information on production operations, farm size, yield, postharvest operations, factors influencing the use of threshing machines and associated challenges.  **Determination of** **threshing performance characteristics**  The following threshing performance indices will be evaluated in maize soybean and groundnut.   1. Throughput capacity 2. Threshing efficiency 3. Grain physical purity 4. Grain moisture content 5. Threshing losses 6. benefit cost ratios   **Determination of Quality Tolerance Limit (QTL)**  This will done in selected markets using both key informant interviews with traders and field assessment of grain samples. In general, quality tolerance limits (QTLs) generally refers to minimum quality limit at which significant actions must be taken to ensure that good/products achieve quality and usability limit. The approach is employed to reduce food safety risk to acceptable levels. In cases such as aflatoxin contamination and food toxins, predetermined QTLs have already been established. The Ghana Standard Authority also has established QTLs for different agricultural commodities, however compliance in local markets requires further consideration.  **Community Demonstrations and Trainings**  Participatory demonstration and training sessions will be conducted in Africa RISING communities. Four participatory demonstration and training sessions will be conducted for 300 farmers (~50 to 75 participants per community) in 4 AR communities (Bonia, Gia, Nyangua, Sambligo, Tibale, Doku). Training sessions will comprise 2-hours of technical information and 2-hours of hands-on operation of the machines. Training messages will be focused on: benefits of using grain threshers, identifying appropriate harvest indices, determination of grain moisture, shelling performance of machine, grain cleaning, grain protection options and best grain storage practices. The growers will be linked to implement suppliers and manufacturers and other related services. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **5. Data to be collected and uploaded** | | | | | | | | | | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | | | | | **Responsibility** |
| 5.1 Field protocols and field survey tools developed to collect data | | | | | | | | | | | | | | SARI |
| 5.2 Field measurement data on performance characteristics (Machine productivity, % threshing losses, % grain purity, % threshing efficiency, % grain moisture) | | | | | | | | | | | | | | SARI |
| 5.3 Processed data in Excel and SPSS and other softwares | | | | | | | | | | | | | | IITA |
|  | | | | | | | | | | | | | | |
| 6**. Milestones** | | | | | | | | | | | | | | |
| **Deliverables** | | | | | | | | | | **Means of verification** | | | **End date** | |
| 6.1. Field surveys and field measurement of threshing performance conducted in 4 select districts | | | | | | | | | | Link to training report and annual report | | | Feb. 2021 | |
| 6.2. Market and consumer surveys on quality tolerance limit and threshold grain assessed. | | | | | | | | | | Link to survey report, Annual report | | | Feb. 2021 | |
| 6.3 Data on socio-economics, benefit-cost and gender issues in postharvest technologies generated and analyzed | | | | | | | | | | Annual report | | | June 2021 | |
| 6.4. Community demonstrations and trainings organized in 6 selected project communities | | | | | | | | | | Link to training and annual report | | | Feb. 2021 | |
| 6.5. Data on number of farm-families utilizing and seeking for threshing machines in communities generated. | | | | | | | | | | Monitoring evaluation reports | | | June 2021 | |
| 6.6. A technology brief on the role of threshing machines in improving postharvest activities developed | | | | | | | | | | Link to the publication, print out | | | Nov. 2020 | |
| 6.7. Process data on dataverse; and develop 1 manuscript from multi-year data. | | | | | | | | | | Link to data source available | | | Nov 2021 | |
| 6.8. Networks provided for farmers and communities to access threshing, mechanization, and related services | | | | | | | | | | List of FBOs networked | | | June 2021 | |
| 6.9 Contribute towards the development of the West Africa Handbook | | | | | | | | | | Book chapter published | | | Nov 2020 | |
|  | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | |
| **Domain** | | **Indicators** | | | | **Metric & Scale** | | | | **Approach**  **Used in Data Collection** | | **Before Intervention** | | **After Intervention** |
| 7.1 Productivity | | Food saved | | | | losses (%) | | | | Survey data,  Field measurement | |  | |  |
| 7.3 Economic | | Profitability  Time saved  Labor use | | | | % losses  Net income,  Number of hour/crop | | | | Field survey,  Price differentials  Recall surveys | |  | |  |
| 7.4 Social | | Social cohesion  Leisure time  Group membership | | | | Time saved (hr)  Participation in FBO activities | | | | Recall of labor time, direct observation | |  | |  |
| 7.5 Human | | Food security (availability and access)  Nutrition | | | | Number of hunger months (months) at household income  Food consumption score | | | | Recall of food used  Recall surveys | |  | |  |
|  | | | | | | | | | | | | | | |
| **8. How will scaling be achieved?** | | | | | | | | | | | | | | |
| 8.1. At the community level, this will be achieved through i)community training and demonstrations, ii) by linking the FBOs to mechanization unit of MoFA for future capacity training and, iii) by linking the groups to local equipment manufacturers and private individuals who offer such related services.  8.2 Results of these activities will be presented at workshops and conferences to share our experience with any partner engaged in mechanization targeted at smallholder farmers.  8.2 Using technology briefs, the study results will be presented in simple text for use by the public and non-scientific audiences.  8.3. The Project Team has been approached by the Soybean Innovation Lab (SIL) seeking to learn how they can potentially mimic a similar approach around technology transfer mechanisms. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **9. How are the activities in this protocol linked to those of others?** | | | | | | | | | | | | | | |
| Data collection will identify gender issues, related socio-economic benefits as well as benefit cost analysis of utilizing threshing machines. | | | | | | | | | | | | | | |
| **10. Custom indicators** | | | | | | | | | | | | | | |
| * Number of farmer field days organized on best harvest practices and operations * Number of field surveys conducted * Number of training sessions organized * Number of project reports produced * Number of technical leaflets and policy briefs produced * Number of journal articles submitted/published | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **11. Impact-based summary matrix** | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing? | | | | | | | | | | | | | | |
| The sub-activities are expected to address the following major development challenges: (i) low farm level productivity leading to food insecurity in communities, (ii) high postharvest losses, and drudgery associated with manual threshing operations (iii) little time availability by farmers to participate in off-farm enterprises such as dry-season gardening (iv) low food quality and safety resulting in poor household nutritional status and income. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | |
| **Budget line item** | | | | | | | **CSIR-SARI** | | | | | | | |
| Personnel | | | | | | | 2,500.00 | | | | | | | |
| Services | | | | | | | |  | | | | | | |
| Supplies | | | | | | | 2,700.00 | | | | | | | |
| Capital | | | | | | |  | | | | | | | |
| Travel | | | | | | | 3,500.00 | | | | | | | |
| Overhead (15%) | | | | | | | 1,305 | | | | | | | |
| **Total** | | | | | | | **10,005.00** | | | | | | | |

**13. Gantt Chart**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2020 | | | | | | 2021 | | | | | |
| Month | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
| Field survey on threshing performance in maize, soybean and groundnut |  |  |  |  |  |  |  |  |  |  |  |  |
| Field survey on quality tolerance limit of grain assessed. |  |  |  |  |  |  |  |  |  |  |  |  |
| Analyze socio-economic, benefit-cost and gender issues different postharvest operations characterized |  |  |  |  |  |  |  |  |  |  |  |  |
| Community demonstrations and training in select project communities |  |  |  |  |  |  |  |  |  |  |  |  |
| Farmer schools to increase utilization and adoption of threshing machines in communities. |  |  |  |  |  |  |  |  |  |  |  |  |
| Develop 1 technology brief on the role of threshing machines |  |  |  |  |  |  |  |  |  |  |  |  |
| Process data and upload onto dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| Develop 1 manuscript for publication from 2 years field work |  |  |  |  |  |  |  |  |  |  |  |  |
| Link farmers to artisans and mechanization unit of MoFA |  |  |  |  |  |  |  |  |  |  |  |  |
| Assessment of Africa RISING SI technologies |  |  |  |  |  |  |  |  |  |  |  |  |
| Contribute to the WA Handbook |  |  |  |  |  |  |  |  |  |  |  |  |
| M&E for verification, annual reporting |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned Work** | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 2: GH2212-20** | | | | | | | | | | | | | |
| Outcome 2: More farmers and farm families are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition. | | | | | | | | | | | | | |
| a. Output 2.2 | | | Postharvest technologies and practices to provide options for the food and feed sectors are tested and disseminated to farmers, through researchers, extension staff, and development partners. | | | | | | | | | | |
| b. Activity 2.2.1 | | | Introduce, evaluate, adapt and disseminate existing postharvest technologies and practices. | | | | | | | | | | |
| c. Sub-activity GH2212-20 | | | Monitoring group dynamics among users of small-scale maize shelling machines in Northern Ghana. | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | |
| Name | Institution | | Role | | | | | | | | | | |
| Bekele Kotu | IITA | | Agricultural economist, activity leader, economic and institutional analysis | | | | | | | | | | |
| Gundula Fischer, Kipo Jimah | IITA | | Social scientist, assessment of social dimension | | | | | | | | | | |
| Mirja Michalscheck | WUR | | Agricultural systems expert, typologies and power relations | | | | | | | | | | |
| Abdul Rahman Nurudeen | IITA | | Agronomist, assessment of productivity dimension | | | | | | | | | | |
| Abdulai Adams | CSIR-STEPRI | | Agricultural economist and Policy analyst, policy analysis | | | | | | | | | | |
| Fred Kizito | IITA | | NRM scientist, assessment of environmental dimension | | | | | | | | | | |
| Benedict Boyubie | IITA | | FtF indicators and ensure data upload on Dataverse | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | |
| Name | Institute | | Degree | | | Start | | | End | | | | |
| NIL |  | |  | | |  | | |  | | | | |
|  | | | | | | | | | | | | | |
| f. Location(s) | | Northern Region, Upper West Region, Upper East Region | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| g. Start | | October 2019 | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | |
| Mechanization is an important complement, and in some cases, a necessary condition, to agricultural intensification. It constitutes several implements and machines which can substitute or supplement human labor to carry out energy/power-intensive operations (such as land preparation, harvesting and threshing) as well as control intensive operations (such as planting and weeding) (Pingali, 2007[[18]](#footnote-18)). While agricultural mechanization importantly reinforced the productivity gains of the Asian green revolution, current scholarly opinions indicate that mechanization may even play a larger role to intensify African agriculture due to the high land-to-labor ratio in many African countries such as Ghana, Tanzania, Nigeria, Senegal, and Zambia (Nin-Pratt and McBride, 2014[[19]](#footnote-19)). That is when existing land has to be more intensively cultivated, mechanization will be adopted to complement the higher labor demand to accomplish increased activities. Secondly, there are also arguments that agricultural operations are arduous by their nature and mechanization is necessary to reduce the drudgery.  While agricultural mechanization comprises of the application of tools or machines to aid human effort with the objective of eliminating drudgery in all aspects of agricultural production and development (Sisei, 2016[[20]](#footnote-20); Fonteh[[21]](#footnote-21), 2010), agricultural mechanisation in Ghana has often focused on land preparation. However, for mechanization to be beneficial to all actors in the agricultural value chain especially women, mechanizing agriculture in Ghana should take into consideration all activities along the agricultural value chain. For example, women constitute over 85% of the actors in agro processing and food distribution (SEND-Ghana, 2014[[22]](#footnote-22)), yet the mechanization strategy in Ghana has remained focused on pre-harvest with little attention to postharvest.  Shelling is mainly performed by females and mechanizing shelling of maize is an important drudgery reduction technology that will benefit women. It will reduce workload of females, the time spent on shelling and allow females time for other tasks and also reduce the health risk associated with manual shelling (Van Eerdewijk and Danielsen, 2015[[23]](#footnote-23)). The Africa RISING project has introduced maize shelling to 17 farmer groups within its intervention sites. As part of the project research to gain gender insights in Africa RISING technologies, the study seeks to engage the beneficiaries of the maize shelling machines to obtain an in-depth understanding of the gender issues surrounding access, adoption and sustainability of maize shelling machines as a labour saving equipment and inform discussions and decisions on gender-responsive strategies and practices to be chosen for dissemination.  Drudgery has increasingly become important to explain the opportunity cost of labor, particularly for the youth, who can otherwise be engaged in less laborious urban-based employment although they may be less productive (Mrema *et al*., 2008[[24]](#footnote-24)). Most of the laborious activities such as manual threshing are usually carried out by women and hence the adoption of mechanization may improve the welfare of women. Thirdly, the adoption of mechanization can also reduce harvest and postharvest grain losses. For instance, a study indicates that the use of a combine harvester reduced grain losses by 20-35 percent as compared to manual threshing (Hassena *et a*l., 2000[[25]](#footnote-25)).  In view of these advantages, in phase 1, the Africa RISING research team introduced two types of small-scale maize shelling machines, one diesel operated and the other one electrically operated. We assessed the economic benefits of the two types and found that both increase labor efficiency among smallholder farmers while saving costs. Farmers can save up to 36 hours per ton of maize shelled if they use the shelling machines.  Based on these results, the machines were demonstrated to many farmers (N = 1,054) in December 2018. Farmers expressed great interest in using the machines. They preferred the diesel-powered machine to the electric machine because of its better design (i.e. wider conveyor system that can take many cobs at a time) and its higher efficiency. To facilitate scaling and technology transfer towards empowering smallholder farmers, Africa RISING facilitated the transfer of the diesel-powered maize shelling machines to groups of farmers who fulfilled the eligibility criteria set by the project. The eligibility criteria included that the groups should craft their own constitution and contribute about 25% of the shelling machine’s estimated market value. Another eligibility criterion was gender balance in leadership – a point to be stipulated in the constitutions. The groups were linked to local artisans who may provide professional support such as maintenance, adaptation and repair services if the need arises. We will consider the technology transfer to be successful if the maize sheller machines remain in frequent use by the community members and that the community members themselves consider the user agreement and its effectuation as fair.  For the economic domain, we hypothesize that the utility (benefits) that farmers get from the maize shelling machine and the performance of the machine are influenced by the quality of their constitution and its implementation (i.e. its validity, comprehensiveness, and flexibility (collective choice and operational rules) applied regarding the use of the machines) while the performance of the constitution will be influenced by the perceptions that the farmers have on the benefits of the machine. Apart from the utility in the economic domain, the social analysis will examine the cultural norms and socio-economic institutions that manifest themselves in group dynamics and constitutions. These may increase benefits for some community or group members and limit access to mechanization for others. Social dynamics may revolve around a variety of stratifying criteria (gender, age, education, migrant versus native status, group leaders, ordinary members and non-members, etc.).  Apart from investigating group dynamics, the gender component will be linked to a broader study of the maize value chain (see separate work plan and budget for GH3122-20). It will examine the differential opportunities and constraints for value chain participation that male and female farmers, processors as well as grain traders and other value chain actors experience.  From an environmental perspective, diesel’s effects on air, water, and soil are multifold: Beyond the fumes, if not handled properly, diesel engine leaks can have adverse environmental consequences. Hydrocarbons are released from these leaks into the atmosphere, ground, and groundwater. Runoff from the leaks and spills enters surface water, while atmospheric deposition adds to ground and surface water contamination[[26]](#footnote-26). Nitrogen oxides and hydrocarbon emissions have been identified as toxic substances with a potential for adverse health effects[[27]](#footnote-27). This study will caution farmers on handling and avoidance of spills to avoid detrimental environmental and human health impacts. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | |
| 2.1 To assess and describe the dynamics and the rules of engagement among group members, non-group members, and other stakeholders with whom they are interacting to make use of the maize sheller. | | | | | | | | | | | | | |
| 2.2 To compare and contrast different user groups (with their particular composition of farm and farmer types) to determine which groups have been most successful in mechanization and why | | | | | | | | | | | | | |
| 2.3 To reveal factors that hindered a successful implementation so that future user agreements may be shaped to avoid these hampering factors | | | | | | | | | | | | | |
| 2.4 To examine how factors such as grain moisture content and machine use efficiency affect the quality of maize grains shelled | | | | | | | | | | | | | |
| 2.5 To investigate the extent to which mechanization is promoted and implemented in agricultural development ordinances and policies in Ghana at various levels ranging from the community level, district level and national level | | | | | | | | | | | | | |
| 2.6. Smallholder sensitization options for diesel handling to and avoidance of spills that can have detrimental environmental and human health impacts. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 3. Research questions  Main research question: How can the user agreements best contribute to full and fair utilization of the maize shellers at the community level? | | | | | | | | | | | | | |
| 3.1 Do the user groups show differences among themselves in terms of the rules and norms, which govern the use and management of the machines? And if yes: describe these differences (including those related to the gender composition of group members and leadership). | | | | | | | | | | | | | |
| 3.2 Do the groups show differences among themselves in terms of success/failure (measured vis-a-vis the sustainable intensification assessment domains)? | | | | | | | | | | | | | |
| 3.3 What are the sources of success/failure and how do these sources contribute to the success/failure of the group in the process of mechanization? | | | | | | | | | | | | | |
| 3.4 How does the usage of the maize shellers by the different group of farmers affect the quantity and quality of maize grains? | | | | | | | | | | | | | |
| 3.5 What are the enabling policy strategies or ordinances and bylaws on agriculture mechanization, and to what extent have they been implemented at the district and farm household levels? | | | | | | | | | | | | | |
| 3.6 What are the male and female farmers preferences for maize shelling? | | | | | | | | | | | | | |
| 3.7 What benefits do male and female farmers derive from use of maize shelling machines? | | | | | | | | | | | | | |
| 3.8 What rules and norms govern the use and management of the maize shelling machines? | | | | | | | | | | | | | |
| 3.9 How does the rules and norms that govern the use and management of machines affect intra-household access to and use of maize shelling machines? | | | | | | | | | | | | | |
| 3.10 How does access to and use of maize shelling machines differ between group leaders, group members and nongroup members? | | | | | | | | | | | | | |
| 3.11 What factors drives sustainability of the maize shelling machines? | | | | | | | | | | | | | |
| 3.12. How can we incorporate sensitization options for better diesel handling and avoidance of spills that can have detrimental environmental and human health impacts? | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 4. Procedures (survey methods, sex disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | |
| 4.1 Systematic comparison of written constitutions followed by a collection of narratives on (1) the actual implementation of the constitution as well as (2) ongoing group dynamics. Group dynamics will further be explored by determining individual / sub-group-interests as well as their power shares (quantified) using the stick-score method described in Michalscheck (2019).  4.2 The success or failure of a group will be measured by collecting narratives that allow a comparison between ‘group objectives’ as defined in the constitution and actual ‘group-level outcomes. We also compare the group’s objectives and outcomes with the ‘expectations’ (increase in mechanization --> productivity/less labor) by Africa RISING.  4.3 For each case study (N=X), by means of semi-structured individual interviews and focus group discussions, we explore factors that led to the success or the failure of the communal maize sheller use. We then compare these factors among the intervention sites to determine common patterns and ‘the main lessons learnt’ in order to provide clear advice for the institutional set-up of the communal ownership of agricultural machinery, using the example of the maize sheller. We will furthermore engage with partners and other research for development projects to share the lessons learnt and eventually to add their experience to our assessment, too.  4.4 Selected policy documents on agricultural development, annual development plans and reviews will be reviewed, and relevant stakeholders in the formulation and implementation of policies interviewed.  4.5. A survey will be conducted to collect quantitative data. This will be a follow-up of the survey conducted in 2020 and hence will involve the same people in the interviews. The data to be collected include, among others, group income from shelling services, expenditures, quantity of maize shelled by members and non-members.  4.6. For the gender study, of the 17 maize sheller groups, a total of 10 (from the 3 regions) will be sampled. The approach for the study is qualitative, and it will involve male and female focus group discussions. Key informant interviews will be held with artisans and other stakeholders. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | Responsibility/Institute | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | |  | | | | | |
| 5.1 Systematic comparison of user constitutions, economic analysis, as well as qualitative descriptions of their actual implementation. | | | | | | | | Bekele Kotu/IITA | | | | | |
| 5.2 A qualitative/quantitative description of the success or failure of the maize sheller use based on the user agreements (for different farm and farmer types). | | | | | | | | Bekele Kotu/IITA,  Mirja Michalscheck/WUR | | | | | |
| 5.3 Quantity of shelled maize grains, % maize grain breakages and grain moisture content | | | | | | | | Abdul-Rahman Nurudeen/IITA | | | | | |
| 5.4 Quantity of fuel used and qualitative data on environmental aspects. | | | | | | | | Fred Kizito/IITA | | | | | |
| 5.5 A qualitative description of user groups in terms of gender. | | | | | | | | Gundula Fischer/IITA | | | | | |
| 5.6 A qualitative description of historical and current policy on mechanization in Ghana. | | | | | | | | Abdulai Adams/STEPRI | | | | | |
|  | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | |
| Deliverables | | | | | | | | Means of verification | | | | Delivery date | |
| A report that (1) describes and compares the user constitutions, as well as their actual implementation, (2), describes the success or failure of the communal ownership and use of the maize shellers and that (3) describes the reasons for success or failure, allowing recommendations for future communal user agreements. | | | | | | | | Technical report shared | | | | Apr. 2021 | |
| A poster or presentation on an international conference like the Tropentag or the Farming Systems Design conference. | | | | | | | | Link to Poster presentation shared in semi-annual technical Report | | | | Sep. 2021 | |
| 6.1 Quantitative data: data on broken grains, group revenues, group costs, etc. | | | | | | | | Dataverse | | | | Sep. 2021 | |
| 6.2 Qualitative data: anonymized and redacted transcriptions. | | | | | | | | Dataverse | | | | Jun. 2021 | |
| 6.3 Articles submitted to a journal | | | | | | | |  | | | | Sep. 2021 | |
| 6.4 Policy Dialogue report/ policy brief | | | | | | | |  | | | | Sep. 2021 | |
| 6.1 Qualitative data on environmental sensitization around diesel handling in communities | | | | | | | | Transcriptions | | | | June 2021 | |
| 6.2 Report on gender issues on maize shelling intervention | | | | | | | | Technical report | | | | June 2021 | |
|  | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | |
| **Domain** | **Indicators** | | | | **Metric & Scale** | | **Approach**  **Used in Data Collection** | | | | **Before Intervention** | | **After Intervention** |
| 7.1 Productivity | * Quantity of shelled maize/unit of labor time * Grain quality | | | | * kg/person/hour, household level * % of grain breakage, household level * Germination percentage | | * On-farm experiment * FGD * Participatory exercise | | | | * 37hours to shell a tonne of maize * No data on rating of grain breakage from manual and machine shelling | | * 1.6hours to shell a tonn of maize * Farmer assessment of grain breakage from manual and machine shelling |
| 7.2 Environmental | * Quantity of diesel consumed * Fuel availability (use of maize stalk for household fuel energy | | | | * liter/ton of maize shelled, household level * % of maize stalks available after shelling for household fuel energy | | * FGD * Participatory exercise | | | | * Little stock available for fuel and high dependence on trees (Tractor shelling shatters maize stalks; putting cobs in bags and beating with sticks shatters stalks) | | * More stock available for fuel which reduce dependence on wood (Reduce deforestation) |
| 7.3 Economic | Income, profit | | | | * Ghana Cedi, group level | | * Household survey * FGD * Participatory exercise | | | | * No income | | * Ghc365 (gross income) (based on one year data) * Ghc245 profit (based on one year data) |
| 7.4 Social | * Gender equity (time allocation)   Social cohesion (collective action) | | | | * Household time spent in manual shelling/threshing of maize * No metrics (qualitative enquiry) | | * Participatory exercise * Household survey * FGD/KII * Participatory exercise * Policy engagements | | | | * 10kg/hour by pressing on the grains with the thumbs[[28]](#footnote-28) * No social cohesion among group members (Individual level performance of farm task including shelling/threshing) * Stakeholders are less aware of the policy issues on mechanization | | * Reduce time spent in shelling of maize * Improved social relations among farmers enhancing knowledge sharing and labour support * Deeper analysis and understanding of policy issues on mechanization among stakeholders |
| 7.5 Human | Capacity to innovate (if groups implemented a self-initiated solution to problems created in the process of using the machine). | | | | * No metrics (qualitative enquiry) | | * Household survey * FGD/KII * Participatory exercise | | | | * Members did not have skill to develop group bylaws/constitution * Limited skill to operate shelling machine | | * Members have skill to develop group bylaws/constitution * Group have capacity to operate and perform minor maintenance |
|  | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | |
| The findings of our study will (1) enable Africa RISING and our partners (in Ghana and beyond) to foster the use of maize shellers and other agricultural machinery through institutional support/best-practice-guidelines for drafting effective user constitutions. (2) Results of this study will be presented at workshops and conferences to share our experience with anyone engaged in the mechanization of smallholder farming. (3) We have been approached by the Soybean Innovation Lab (SIL) seeking to learn how they can potentially mimic a similar approach around technology transfer mechanisms, SIL reaches thousands of farmers and this will be an opportunity to Africa RISING approaches to touch or influence similar donor initiatives potentially impacting smallholder farmers. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | |
| This study is linked to earlier and current works of the Africa RISING research team on farmers’ typologies in Northern Ghana, forage choppers in Tanzania, and policy and institutional analysis and will also draw on lessons learnt from the aforementioned works. This activity also contributes to Outcome 1 (Output 1.3), Outcome 3 (Outputs 3.1 & 3.2) and Outcome 4 (Outputs 4.1-4.4). The study is also linked to a gendered maize value chain analysis to be conducted within the same work plan period (GH3122-20). | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | |
| * Published papers in peer-reviewed journals and conference presentations * Policy dialogue events organised at local and national levels * A technical report on gender analysis | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Most smallholder farmers in northern Ghana do not have access to mechanized maize shelling despite the presence of rental services. The reason is that rental service providers do not consider smallholders as economically feasible customers to provide door-to-door services. Thus, maize shelling is undertaken mainly using the manual method among such farmers. The manual method takes much of the farmers’ time which otherwise could have been used for other activities. Moreover, the manual method is arduous which many farmers would like to avoid. Therefore, this study will provide useful evidence on a new business model, i.e. the group model, to improve the access of smallholder farmers to shelling mechanization thereby improving labor productivity and farmers’ welfare. While the introduction of the small-scale maize shelling machines by the Africa project will be leverage to farmers especially female farmers, existing gender issues may affect their participation in the maize shelling group and limit the potential benefits of the intervention to females. One of the aim of this study is to unearth gender issues in access and use of the maize shelling machines provided by the Africa RISING project and inform the intended business model to be developed on smallholder maize shelling. | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  This study mainly targets smallholder farmers in Africa RISING intervention areas. Moreover, the findings of the study can be useful to various stakeholders such as government extension agents, NGOs, and policymakers to enhance the mechanization of maize shelling and beyond. Furthermore, it will help the private sector (machine importers, local artisans, fabricators, etc.) to benefit from the mechanization of smallholder agriculture. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | |
| **Budget line item** | | | | **IITA** | | | | | | **CSIR-STEPRI** | | | |
| Personnel | | | | 7000 | | | | | | 1,500 | | | |
| Services | | | | 5000 | | | | | | 2,000 | | | |
| Supplies | | | | 1000 | | | | | | 500 | | | |
| Capital | | | |  | | | | | |  | | | |
| Travel | | | | 5000 | | | | | | 1,000 | | | |
| Overhead | | | |  | | | | | | 750 | | | |
| **Total** | | | | **18,000** | | | | | | **5,750** | | | |
| **Grand total** | | | | **23,750** | | | | | | | | | |

13. Gantt Chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Activity/Year | 2020 | | | | | | | | | | | | 2021 | | | | | | | | |
| J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S |
| Assess functionality of maize shellers groups and machines |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection (grain quality, environment) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection socioeconomic (economics, institutions, gender, policy) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data organization and analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Hold policy dialogue events at the local and national levels on gaps in agricultural mechanization policies in Ghana. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Working on publications |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Finalization of activity outputs |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned Work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 3:** **GH3111-20** | | | | | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies | | | | | | | | | | | | | | |
| a. Output 3.1 | | Improved policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are developed | | | | | | | | | | | | |
| b. Activity 3.1.1 | | Address constraints to and opportunities for improving access to the output and input markets by actors including paying particular attention to women and youth in the target area | | | | | | | | | | | | |
| c. Sub-activity GH3111-20 | | Strengthen the technical, managerial and organizational capacities of the major actors in small ruminant value chain through institutional structures such as Producers’ Association, Value Chain Development Units, District Assemblies (DAs), Community Based Organizations, Traders’ Associations, Processors’ Associations, Transporters and Input Dealers Associations | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | | Institution | | | Role | | | | | | | |
| Augustine Ayantunde | | | | ILRI | | | Coordination of sub-activity, provision of supervision and general control on the project as well as technical backstopping, data analysis, review of reports and final reporting | | | | | | | |
| Franklin K. Avornyo | | | | ARI | | | Coordination and implementation of project activities, training of farmers, functioning of Innovation Platforms, data collection and reporting of activities | | | | | | | |
| Mohammed T. Shaibu | | | | ARI | | | Implementation of project activities, project review, reporting and lead in design of field instruments | | | | | | | |
| Emmanuel Panyan | | | | ARI | | | Implementation of project activities, project review and reporting | | | | | | | |
| The District Director | | | | Department of the Ministry of Agriculture (DoA) | | | Help link the various actors and increase their access to technologies and information as well as lead in the execution of complementary activities | | | | | | | |
| Benedict Boyubie | | | | IITA | | | FtF indicators and ensure data upload on Dataverse | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | Institute | | | | | | Degree | | Start | End | | |
| Nil | | |  | | | | | |  | |  |  | | |
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| f. Location(s) | | | 1. Upper East Region: Kassena Nankana Municipal and Kassena Nankana West  2. Upper West Region: Wa West and Wa Municipal | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | | | August, 2019 | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | | | June, 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| The economy of Ghana is largely agricultural contributing about 19.7% of the Gross Domestic Product. Crop based agricultural products account for 14.5% with only 2.7% contributed by domestic animal production (GSS, 2019). Frozen fish and meat products are listed among the top ten imported commodities to Ghana (UN Comtrade, 2017). Low level of in-country animal products contributes to the negative deficit. This imbalance in crop and animal agriculture is also reflected on the plate of everyday Ghanaians with more than 70% of protein coming from starchy foods such as cereals, roots and tubers. Inadequate intake of animal protein has contributed to prevalence of stunting among school children and alarmingly increasing overweight population in the country (FAO-STATS, 2010).  Most of livestock related activities take place in northern Ghana which is considered the bread basket of the country. Therefore, scaling up agriculture as a means for poverty alleviation has long been proposed with a number of interventions initiated. However, impact of these have been minimal due to multiple factors.  It appears quite clearly that the livestock sector in Ghana has not been given the needed attention. Burkina Faso has a National Director in charge of Value Chain Development in the Directorate of Animal Resources and Fisheries and is responsible for all livestock value chain development activities of the country. The focus of the Government of Ghana is also on the development of agribusiness models and the policy is to use the value chain approach. Consequently, there is an Agribusiness unit at the headquarters of the Ministry of Food and Agriculture but no unit on value chain development has been created. In fact, there appears to be no clear policy guideline governing the operation of the value chain approach. This notwithstanding, the Government of Ghana has, in recent times, rolled out plans and projects in which the small ruminant is one of the key commodities. Under the Government’s flagship project on ‘Rearing for Food and Jobs’, small ruminant production is being promoted and there is an intention to revive a Meat Processing factory in Zuarungu in the Upper East Region. For now, as far as the small ruminant value chain is concerned, it appears the focus of the Ministry of Food and Agriculture is on producers, and issues concerning trading and processing may be subsumed under the Ministry of Trade and Industry. Feedback from traders and processors points to a collapsing small ruminant business.  Small ruminant producers in Ghana are not organized into associations while in Burkina Faso, it is a requirement for producers to form cooperatives, and projects work with cooperatives. Their feed sellers are also organized. The Government of Burkina Faso has in recent times been organizing free vaccination exercises against peste des petits ruminants (PPR) for farmers’ small ruminants and this intervention has helped to reduce their small ruminant mortality rate to around 12%. In Ghana, small ruminant mortality rate exceeds 30%. There is the need to strengthen the linkage between the veterinary service and the producers in Ghana. Small ruminant value chain actors in Burkina Faso are eligible to access substantial amounts of loan (CFA 3,000,000 up to even CFA 500,000,000).  It is for these disparities that the leadership of the Ghana National Livestock Breeders’ and Traders’ Association has been blaming Ghana Government for the livestock industry’s misfortunes, citing neglect as the main cause. However, the sector has a huge potential to offer employment, particularly, in the upstream segment of the value chain, to the youth in the country. The incidence of the activities of suspected Islamist militants is resulting in the death of Burkina Faso soldiers and farmers and farm families are fleeing their homes in the north and Eastern part of Burkina Faso because their security is threatened. The urgency for Ghana to assume responsibility and complement the efforts of Burkina Faso is becoming more obvious. In this regard, experience can be drawn from Burkina Faso, on the development of the small ruminant value chain, and organizational, managerial and technical capacities that need to be built for benefits to accrue. Following the above, we will therefore consider the activities associated with small ruminant value chains at the targeted Africa Rising project communities and where work to improve the effective functioning of the entire small ruminant value chain by pushing for MoFA to facilitate the development of the small ruminant value chain. In other words, there are other important issues such as formation of relevant partnerships and capacitating the Ministry of Food and Agriculture to play a lead role in strengthening the capacities of actors. Addressing these constraints will bring help to farmers and other actors including women and the youth in the chain. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 Identify and address organizational, managerial and technical capacity gaps of actors for improved functioning of the small ruminant value chain | | | | | | | | | | | | | | |
| 2.2 Facilitate MoFA to develop small ruminant value chain input and output services as well as increase women and youth participation in the small ruminant value chain | | | | | | | | | | | | | | |
| 2.3 Identify and form relevant partnerships that will enhance the development of the small ruminant value chain | | | | | | | | | | | | | | |
| 2.4 Conduct an evaluation study on sustainable intensification (SI) indicators and on already implemented interventions in order to measure impact and learn lessons | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 To what extent will the implementation of recommendations from Burkina Faso help to improve the functioning of the small ruminant value chain in the project locations? | | | | | | | | | | | | | | |
| 3.2 To what extent will engagements with MoFA, National Livestock Breeders’ and Traders’ Association and local Government Authorities improve the role of MoFA as lead facilitators in the development of the small ruminant value chain? | | | | | | | | | | | | | | |
| 3.3 What partnerships will be relevant in supporting the growth of the small ruminant value chain to the benefit of Africa Rising project farmers? | | | | | | | | | | | | | | |
| 3.4 How does a project aimed at strengthening the small ruminant value chain impact on Africa RISING project community members including women and the youth? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| **Identify and address organizational, managerial and technical capacity gaps of actors**  The Burkina Faso National Director in charge of Livestock Value Chain Development will be engaged to shed ideas on best practice in small ruminant value chain development. This will involve identifying options for building the organizational and managerial capacities of small ruminant value chain actors as well as ensuring sustainable functioning or transformation of Innovation Platforms into a group referred to as ‘Inter-professional’. Ideas will also be gathered at meetings with the Burkina Faso National Director in charge of Livestock Value Chain Development and other key actors in Ghana on how best to improve upon the membership of the Innovation Platform. Actors with business motives will be targeted and executives may be chosen for the IP for it to be self-sustaining.    **Facilitate MoFA to support and coordinate the development of small ruminant value chain input and output services as well as increase women and youth participation**  The project will engage the management of Livestock Breeders’ and Traders’ Association, Agribusiness Unit of MoFA, GIZ, Animal Production Directorate and the Minister of Agriculture. The reason for the engagement will be to discuss how MoFA could take up the ultimate responsibility for the growth and proper functioning of the small ruminant value chain in Ghana. This will help improve employment opportunities especially for the upstream actors with a focus on women and the youth in the small ruminant value chain. This will take the form of a series of meetings and workshops that will involve sharing of project findings with Livestock Breeders’ and Traders’ Association, Agribusiness Unit, Animal Production Directorate and Minister of Agriculture as well as a proposal to include Value Chain Development in the Organogram of the Ministry. The project will partner with Departments of Agriculture to address specific constraints along the small ruminant value chain. Innovation Platform members will organize review and planning meetings as well as participate in the implementation and coordination of activity plans aimed at improving the performance of the value chain.  **Identify and form relevant partnerships**  With the help of insights gained from Burkina Faso experience and engagements with policy in Ghana, members of the Innovation Platforms will conduct stakeholder mapping and analysis around different actors and Business Development Services in the small ruminant value chain. New partnerships will be formed with relevant projects, NGOs, Municipal/District Assemblies and Ministry of Food and Agriculture with the aim of strengthening the small ruminant value chain in Ghana. Partnerships may also include Community Animal Health Workers, Voluntary Services Organization (VSO) and Veterinarians/Engineers without Borders.    **Conduct an evaluation study on SI indicators and the associated interventions**  First of all, the project will verify some baseline findings by use of triangulation and clarify baseline information. An evaluation study will then be conducted on Sustainable Intensification indicators and interventions that have been implemented in order to assess impact and learn lessons. Putting into consideration selected SIAF domains, the study will assess small ruminant productivity; soil quality will be determined for a selected number of project beneficiary farmers; incomes they make and their labour input into small ruminant activities will also be determined. The project will also scout for success stories. | | | | | | | | | | | | | | |
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| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | | Responsibility |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | | | | |  |
| 5.1 No specific data to be uploaded but there will be reports | | | | | | | | | | | | | | CSIR-ARI |
| 5.2 No specific data to be uploaded but there will be reports | | | | | | | | | | | | | | CSIR-ARI |
| 5.3 No specific data to be uploaded but there will be reports | | | | | | | | | | | | | | CSIR-ARI |
| 5.4 Evaluation survey data on small ruminant numbers, small ruminant byproducts, soil nutrient levels, household income levels, labour requirements, level of organization of existing small ruminant value chains, collective actions, information access, level of adoption of proven technologies by actors and linkages to other actors and markets | | | | | | | | | | | | | | CSIR-ARI |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | End date | | | |
| 6.1 Meeting reports on meetings in Ghana with the Burkina Faso National Director in charge of Livestock Value Chain Development | | | | | | Meeting report containing:  -information on policy guidelines that are needed to govern the operation of a small ruminant value chain  -clear suggestions on what organizational, managerial and technical capacities to build in actors of the small ruminant value chain and how they can be achieved  -suggestions on the composition and how the Innovation Platforms could best function  -potential partners of the small ruminant value chain  Feedback on meetings with the Burkina Faso National Director in charge of Livestock Value Chain Development provided in the semi-annual Report. | | | | | October, 2020 | | | |
| 6.2 Meeting report on meetings with Ghanaian National Stakeholders including Executives of Livestock Breeders’ and Traders’ Association, Agribusiness Unit, Animal Production Directorate, Minister of Agriculture, and GIZ | | | | | | Meeting report containing:  -clear suggestions on what institutional structure to be established and how it should be established to provide leadership in the development of the small ruminant value chain  -commitments to developing the small ruminant value chain e.g. proposals to include Value Chain Development Unit in the Organogram of the Directorate or Ministry  -plans or revelation of a policy guideline governing the operation of the value chain  -potential partners of the small ruminant value chain  Feedback on meeting with the National stakeholders provided in the semi-annual report. | | | | | November, 2020 | | | |
| 6.3 Meeting report on the Innovation Platform and Department of Agriculture, and implementation of prioritized constraints | | | | | | Lists of attendance  Report on activities of the platforms including:  -review and planning meetings  -stakeholder mapping and analysis  -addressing prioritized constraints  Feedback on Meeting of IPs and Dept. of Agric on implementation of prioritized constraints provided in the annual report | | | | | March, 2021 | | | |
| 6.4 Review of baseline report | | | | | | An improved version of previous year’s report on project | | | | | October, 2020 | | | |
| 6.5 Meeting report on meetings with prospective partners | | | | | | Meeting report  Attendance list  Feedback on meeting with prospective partners provided in the annual report | | | | | March, 2021 | | | |
| 6.6 More sustainable Innovation Platforms | | | | | | Information on integration of Innovation Platforms with already established associations, e.g. Traders’ Association, platforms, e.g. R4DP or office e.g. Department of Agriculture | | | | | March, 2021 | | | |
| 6.7 Evaluation survey report | | | | | | Survey instrument  Survey data  Report on level of organization, actor linkages, natural resource management, technology adoption, income and animal productivity  Lessons learnt from previous interventions | | | | | May, 2021 | | | |
|  | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | |
| **Domain** | **Indicators** | | | | **Metric & Scale** | | | **Approach**  **Used in Data Collection** | | **Before Intervention** | | | **After Intervention** | |
| 7.1 Productivity | Animal productivity | | | | Animal numbers  (number/hh/yr) at the hh level  Animal by-products  (by-product/hh/yr) | | | Survey instruments | |  | | |  | |
| 7.2 Environmental | Soil biology  Soil chemical quality | | | | Total carbon (% or mg/ha) at field level  Soil pH at field level  Soil nutrient levels at field level | | | Soil sampling and analysis | |  | | |  | |
| 7.3 Economic | Profitability  Labor requirement | | | | Net income (total net income for small ruminant activities) at the household level  Labor requirement (hours) at hh level  Farmer rating of labor at hh level | | | Survey instruments | |  | | |  | |
| 7.4 Social | Gender equity  Collective action | | | | Access to information at hh level  Collective action groups at the community level | | | Survey instruments | |  | | |  | |
| 7.5 Human | Nutrition  Capacity to experiment | | | | Access to nutritious foods at hh level  Number of new practices being tested at hh level | | | Survey instruments | |  | | |  | |
|  | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | |
| Scaling will be done through a series of meetings and deliberations, and sharing of project recommendations. There will be recruitment of people with passion onto the Innovation Platform and formation of new strategic partnerships with NGOs and DoA to bring more benefits to women, youth, feed sellers and small ruminant producers in particular. Members’ capacities will be built in organizational, managerial and technical skills and actor linkages and market access will be improved.  The project will intensify its engagements with the Department of Agriculture so that this department can be facilitated to assume more responsibility for the small ruminant sector and deliver on its plans such as on construction of small ruminant model houses for farmers, improving access to animal healthcare, increasing stock size, breed quality and breeding, facilitating the formation of producer organizations and improving small ruminant survival rate. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | |
| These activities are a sequel to the previous protocol. While the previous protocol focused on a situation analysis of the small ruminant value chain with a view to strengthening it, this protocol aims at targeting interventions that have the greatest chances of supporting small ruminant producers and other vulnerable groups in the small ruminant value chain.  Also, feed for small ruminants is a major challenge especially during the farming season. Consequently, farmers were trained in feed formulation and efficient feeding. Farmers can experiment with developing their own feeds and offering them in efficient feed troughs which are being promoted under other activities under this AR project. | | | | | | | | | | | | | | |
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| 10. Custom indicators | | | | | | | | | | | | | | |
| * Number of potential partners identified and contacted * Number of prioritized constraints addressed * Number of interventions that support the course of producers * Composition of Innovation Platform including influential and important actors/stakeholders, women and the youth * Number of linkages formed or strengthened * Number of project reports produced * Number of technical leaflets and policy briefs produced * Number of journal articles/case studies submitted/published | | | | | | | | | | | | | | |

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| 11. Impact-based summary matrix | | |
| 11.1 What is the development challenge you are addressing?  Weak linkages among actors in the small ruminant value chain in northern Ghana which if well addressed will enhance participation of smallholder small ruminant producers in the value chain thereby improving their income. | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Service providers, input suppliers, women, youth, small ruminant farmers, traders, transporters, processors, policy makers and consumers | | |
|  | | |
| 12. Budget (US$) | | |
| **Budget Line** | **ILRI** | **RI1A** |
| Personnel |  | 13,136 |
| Services |  | 3,150 |
| Supplies |  | 1,065 |
| Capital |  | 0 |
| Travel |  | 4,388 |
| Overhead |  | 3,261 |
| **Total** |  | **25,000** |

**Reference:**

FAOSTAT (2010). FAO Statistical Year Book 2010. World Food and Agriculture

Ghana Statistical Service (GSS) (2019). Statistics for Development and Progress. Rebased 2013–2018 Annual Gross Domestic Product

UN Comtrade (2017). International Trade Statistics. Import/Export Data

13. Gantt chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/Month** | **2020** | | | | | | **2021** | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** |
| Organize meetings in Ghana with Burkina Faso National Director in charge of Livestock Value Chain Development with recommendations on policy guides, capacity building, operationalizing the Innovation Platform and potential partners of the small ruminant value chain |  |  |  |  |  |  |  |  |  |  |  |  |
| Meetings with Ghanaian National Stakeholders to come out with recommendations for provision of support and coordination of the value chain, plans or revelation of a policy guideline governing the operation of the value chain and potential partners of the small ruminant value chain |  |  |  |  |  |  |  |  |  |  |  |  |
| Identify and form relevant partnerships with NGOs, Municipal/District Assemblies and Ministry of Food and Agriculture with aim of strengthening the small ruminant value chain in Ghana |  |  |  |  |  |  |  |  |  |  |  |  |
| Organize review and planning meetings of Innovation Platforms and Department of Agriculture as well as jointly participate in addressing prioritized constraints |  |  |  |  |  |  |  |  |  |  |  |  |
| Organize meetings with prospective partners |  |  |  |  |  |  |  |  |  |  |  |  |
| Form a more sustainable structure of the Innovation Platforms by integrating with already established associations, platforms or offices, recruiting actors with business motives and passion as well as electing an executive for the IP |  |  |  |  |  |  |  |  |  |  |  |  |
| Verify and clarify baseline findings by use of triangulation |  |  |  |  |  |  |  |  |  |  |  |  |
| Conduct an evaluation studies on Sustainable Intensification indicators, namely, actor organization, linkages, natural resource management, technology adoption, incomes, labour input and small ruminant productivity as well as interventions that have been implemented in order to assess impact, learn lessons and identify success stories |  |  |  |  |  |  |  |  |  |  |  |  |
| Monitoring and reporting |  |  |  |  |  |  |  |  |  |  |  |  |

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| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | |
| **2020 Africa RISING W. Africa Activity Protocol –Outcome 3: GH3112-20** | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | | | | | | | | | | |
| 1. Output 3.1 | | Enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners. | | | | | | | | |
| 1. Activity 3.1.1 | | Review of existing policies and institutional arrangements affecting equitable access to production assets and markets | | | | | | | | |
| 1. Sub-activity GH3112-20 | | Analyze the enabling environment including policies and institutional arrangements and intervention to identify factors that enable the inclusion of women and youth along irrigated vegetable value chain | | | | | | | | |
|  | | | | | | | | | | |
| d. Research team | | | | | | | | | | |
| Name | | Institution | | Role | | | | | | |
| Thai Minh | | IWMI | | The Senior researcher will be responsible for the systemic analysis of the scaling pathway for irrigated vegetable value chain in Ghana and Mali. She will carry out data collection and analysis on SI indicators mainly on social and human condition to evaluate holistic sustainability of the interventions | | | | | | |
| National Researcher Scaling Innovations (TBD) | | IWMI | | The National Researcher will support the data collection on the systemic analysis component. | | | | | | |
| Jean Baptiste Tignegre | | World Veg | | Contribution on vegetable value chain | | | | | | |
| Benedict Boyubie | | IITA | | Support towards meeting project M&E requirements and FtF indicators while ensuring data upload on Dataverse | | | | | | |
| Birhanu Zemadim | | ICRISAT-Mali | | Contribution on sub-activity conducted in Mali | | | | | | |
| Adams Abdulai | | STEPRI | | Contribution to policy analysis in Ghana | | | | | | |
|  | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | |
| Name | | Institute | | | | Degree | | Start | End | |
|  | |  | | | |  | |  |  | |
|  | | | | | | | | | | |
| f. Location(s) | National Level in Ghana and Mali; link to ground level activities in Upper East Region, Ghana | | | | | | | | | |
|  | | | | | | | | | | |
| g. Start | September 2020 | | | | | | | | | |
|  | | | | | | | | | | |
| h. End | May 2021 | | | | | | | | | |
|  | | | | | | | | | | |
| **1. Justification** | | | | | | | | | | |
| In addition to the Bhungroo solar-based irrigation system and drip irrigation, several other research have shown promise of using different water lifting technologies and irrigation management to support off-season vegetable, seed and irrigated fodder production (Okwany and Schmitter., 2016, Schmitter at al., 2016). Moreover, research has identified numerous constraints to expanding the use of irrigation technologies along the value chains. The heterogeneity of farmers and respective demographics influences the preferences for technologies and therefore the level of entrepreneurship. Barriers, which prevent smallholder farmers in Ghana and Mali from entering into or advancing along the value chains are highly contextual and vary within and between countries; some key identified challenges are: (i) insecurity of land tenure; (ii) lack of infrastructure (e.g. roads, access to electricity, well drilling); (iii) limited access to irrigation technologies and/or credit; (iv) lack of after-sale services (e.g. maintenance, spare parts); (v) lack of reliable markets (both in terms of the crop value chains and the technology supply chains), (vi) inadequate or poorly maintained irrigation infrastructure and (vii) changing demographics of people in agriculture (women and shortage of labor) (Nakawuka et al., 2018; Merry and Lefore, 2018; Lefore et al., 2019).    A systemic approach to the scaling of irrigation technology and water management solutions to enhance valuechain functionality is needed through addressing these systemic barriers. The systemic scaling approach helps to explore sustainable pathways to scaling so that irrigation technologies can better support sustainable intensification of household production systems, development of agricultural value chains, and resilience of food systems. To support systemic scaling of irrigation solutions for sustainable intensification, it is essential to conduct an enabling environment assessment to understand enablers and hinderers influencing farmers’ adoption of the technologies, so that measures are put in place to ensure success.  Currently, IWMI is implementing several related initiatives on **systemic scaling of small scale irrigation (SSI) in Ghana and Mali**. Systemic scaling includes (1) water suitability/accounting, (2) enabling environment assessment, (3) co-identification of value chain scaling pathway, and (4) multi-stakeholder dialogues. These research have been conducted under the scope of Africa Rising (Ethiopia), TAAT and ILSSI project.  IWMI therefore proposes the research on systemic scaling to better address the barriers to scaling and integrate irrigation technologies and water management innovations into the agricultural value chain to support sustainable intensification of household production systems in **Ghana and Mali**.  In **Mali**, under the scope of the TAAT project, the enabling environment assessment is being conducted to understand enablers and hinderers influencing farmers’ adoption of the irrigation technologies, so that measures are put in place to ensure successful scaling of irrigation; while the ILSSI project works on water suitability and accounting. Leveraging on this enabling environment assessment in Mali, IWMI proposes the research on contextualizing the enabling environment assessment for irrigated vegetable value chain in **Mali and Ghana**. **The enabling environment in an (irrigated) agricultural value chain is a set of policies, informal institutions, support services and other conditions that create or improve and maintain a general operational environment, bringing together value chain actors in a co-operative manner.** Understanding such micro and macro environments of households and value chains as well as its influence on the scaling of irrigation technologies is important when catalyzing the appropriate enabling environment for integration and scaling of the irrigation technology and water solutions in sustainable manners (Lefore et al., 2019). | | | | | | | | | | |
|  | | | | | | | | | | |
| **2. Objectives** | | | | | | | | | | |
| 2.1. Identify factors that enable the inclusion of women and youth along irrigated vegetable value chain, especially in the output and input markets for irrigated vegetable production | | | | | | | | | | |
|  | | | | | | | | | | |
| **3. Research questions** | | | | | | | | | | |
| 3.1. What characterizes the enabling environment that facilitates the participation of farm families, and enables the inclusion of women and youth along irrigated vegetable value chains? | | | | | | | | | | |
|  | | | | | | | | | | |
| **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.)** | | | | | | | | | | |
| The sub-activity is embedded in the action research outlined under the proposed systemic scaling pathway analysis in outcome 3.2 (GH3211-20). The **policy framework** and **intervention analysis** will involve a review of policy clusters which influence the scaling of irrigation technologies and irrigated vegetable value chain development. The analysis will proceed in six steps, namely: (i) development of an inventory of relevant and existing policy/intervention documents, (ii) individual policy/intervention analysis, (iii) policy/intervention cluster analysis, (iv) cross cluster analysis, (iv) overall analysis, and (v) validation of results.  The results from the policy framework and invention analysis will be consolidated through a synthesis analysis. The synthesis analysis will first characterize the enabling environment for scaling irrigation technologies and irrigated vegetable value chain development by reflecting on the results from analyses of policies and interventions, and draw inferences on:   * achievements and shortcomings in the technology scaling and irrigated vegetable value chain development; * alternative scenarios/solutions/models/approaches that could have addressed the shortcomings/constraints better; and * produce specific policy and implementation recommendations. | | | | | | | | | | |
| **5. Data to be collected and uploaded on Dataverse** | | | | | | | | **Responsibility** | | |
| ***Policy framework*** with different policy clusters including socio-economic development framework, rural and agricultural development, social and gender inclusion, irrigation and water resources management, vegetable production, private sector development, etc.   * Objectives, target areas and beneficiaries, implementation strategies and mechanisms, institutional arrangements, changes in policy framework, conflicts, gaps, shortcomings   ***Enabling and disenabling factors*** to farmers’ participation in irrigated vegetable value chain, drivers, and potentials solutions/recommendations  ***Interventions*** that support farmers’ participation and enable the inclusion of women and youth along irrigated vegetable value chains | | | | | | | | IWMI | | |
| **6. Milestones** | | | | | | | | | | |
| **Deliverables** | | | | **Means of verification** | | | | **End date** | | |
| 6.1 Database and qualitative dataset on enabling environment facilitating the scaling of irrigation and water solutions | | | | Dataverse | | | | June 2021 | | |
| 6.2 Report on enabling factors facilitating the inclusion of women and youth along irrigated vegetable value chain, especially in the output and input markets for irrigated vegetable production in Ghana and Mali | | | | Progress and final report submitted to IITA | | | | July 2021 | | |
| **7. Sustainable intensification indicators (Still need help here)** | | | | | | | | | | |
| **Domain** | **Indicator** | | **Metrics/**  **Scale** | | **Approach used** | | **Before intervention** | | | **After intervention** |
| 7.3 Economic | Income increase from selling irrigated products | | Amount increased per dry season | | Interviews | |  | | |  |
| 7.4 Social | Gender equity | | Rating of technologies by gender-friendliness at household level | | Interviews | |  | | |  |
| 7.5 Human | Food security | | Food consumption from irrigated products | | Interviews | |  | | |  |
|  | | | | | | | | | | |
| **8. How will scaling be achieved?** | | | | | | | | | | |
| Scaling will be achieved by series of stakeholder engagement and system scaling activities, including, but not limited to:   * Using co-generation of knowledge through on-farm demonstration to scale out innovative technologies; * Organizing stakeholder meetings with farmers and extension officers on the results of the trials and the preferred water lifting and application methods during the dry season; * Sharing research results and engaging with potential scaling partners such as regional offices of Ministry of Food & Agriculture (MoFA) and GIDA (Ghana Irrigation Development Authority), the Agriculture Sector Working Group (ASWG) once the technologies and scaling pathways are co-identified and verified; * Linking AR’s irrigation technology and value chain-based scaling pilots with relevant multi-stakeholder dialogues/platforms to integrate the scaling into the platforms’ agendas and to facilitate the systemic changes and capacity to enhance the scaling of irrigation technologies and water solutions   Developing and using fact sheets, workshops, policy briefs, as well as scientific papers to communicate to the wider public actors, practitioners and relevant stakeholders | | | | | | | | | | |
|  | | | | | | | | | | |

\*\*\*12 Budget: This budget is for both Ghana and Mali, thus the sub-activity has been replicated in Mali with no budget figures appended to the workplan.

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| --- | --- |
| **12. Budget Line** | IWMI |
| Personnel | 36,911 |
| Services | 7,060 |
| Supplies | - |
| Capital | - |
| Travel | 28,073 |
| Overhead (17%) | 12,250 |
| **Total** | **84,294** |

**13. Gantt Chart**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2020** | | | | **2021** | | | | | | | |
| **Year/ Month** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Assessment of Africa RISING SI technologies |  |  |  |  |  |  |  |  |  |  |  |  |
| Policy framework analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Irrigation and irrigated value chain intervention analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Reflection, data analysis and report writing |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned Work** | | | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 3: GH3121-20** | | | | | | | | | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | | | | | | | | | | | | | | | | | | |
| a. Output 3.1 | | Enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners. | | | | | | | | | | | | | | | | |
| b. Activity 3.1.2 | | Assess the level of inclusiveness of women and the youth along crop and livestock value chains. | | | | | | | | | | | | | | | | |
| c. Sub-activity GH3121-20 | | Assessing the inclusiveness of women and youth within the vegetable production value chain to enhance vegetable production among small holder farmers. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | | |
| Name | | Institution | | | | Role | | | | | | | | | | | |
| Jean Baptiste Tignegre | | WorldVeg | | | | Sub-activity leader: activities coordination | | | | | | | | | | | |
| Fred Kizito | | IITA | | | | Hosts & advises WorldVeg team in Ghana | | | | | | | | | | | |
| Funke Cofie | | IWMI | | | | Provide support to collect information for higher level synthesis | | | | | | | | | | | |
| Paul A. Zaato | | WorldVeg | | | | Supervise fieldwork and collect data in Ghana | | | | | | | | | | | |
| Atuna Richard | | UDS | | | | Lead the implementation of surveys | | | | | | | | | | | |
| Benedict Ebito Boyubie | | IITA | | | | Develop data collection tools, train the research team on Feed the Future indicators and support in data collection to track output level and Feed the future indicators  Ensure data upload on Dataverse | | | | | | | | | | | |
| District Director of Agriculture | | MoFA, Department of Agriculture | | | | Help link the various actors and increase their access to technologies and information | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 1. Student (s) | | | | | | | | | | | | | | | | | |
| Name | | Institute | | | | | | | | | |  |  | | | |  |
|  | | | | | | | | | | | | | | | | | |
| 1. Location(s) | | 1. Upper East Region: Kasena Nankana Municipality  2. Northern Region: Tamale Municipal | | | | | | | | | | | | | | | | | |
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| 1. Start | | Oct. 2020 | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 1. End | | Sept. 2021 | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | | | | | |
| The vegetable value chain is plagued with several challenges within the Northern sector of Ghana. Prominent among these are low prices, price volatility, lack of access to credit, poor quality of produce, inadequate storage and warehousing facilities, inadequate transportation facilities, scattered nature of source of supply, high interest rate and lack of adequate information. Vegetable varieties technologies trials were conducted since 2012 in Northern Ghana including varieties dissemination, optimized vegetable maize-vegetables intercrops. New WorldVeg and commercialized onion, tomato and pepper varieties proved to be high yielding with market opportunities for small scale farmers. IWMI has developed water management technologies for water use efficiency to sustained vegetable production. However, low access to seeds (seed regulation issues for new promising lines, unavailability of seed enterprises and dealers in the vicinity of farmers’ communities, low capacity of seed and & inputs actors, poor linkages of market & processing industries) proved to be threats to the vegetables value chain. These challenges affect vulnerable persons such as women and youth productivity to varying degrees. Vegetable value Chain strengthening can be an effective instrument with which to fight inequality by expanding women and youth’ incomes and achieving a more balanced value-added appropriation. The involvement of women and youth in the value chain of high value crops such as irrigated vegetables can sustain production and reduce poverty for poor households. There is therefore the need to include women and youth within the Upper East and Northern Regions of Ghana as key players within the value-chain (MOFA, IITA, IWMI, WorldVeg, banks, input dealers, private sector, commodity aggregators, end markets and media) to establish long-term relationships and transform small-scale vegetable production into sustainable businesses. | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | | | | | |
| 2.1 To identify key constraints within crops value chain to sustain food security mechanism for women and youth at community level | | | | | | | | | | | | | | | | | | | | |
| 2.2 To involve women and youth within the crops value chain (Production, irrigation, input supply, processing and market) | | | | | | | | | | | | | | | | | | | | |
| 2.3 To facilitate the active involvement of women and youth in the irrigated vegetable value chain | | | | | | | | | | | | | | | | | | | | |
| 2.4. To create sustainable linkages between women and young vegetable farmers in the value chain based on innovative approaches such as seed & inputs dealers/enterprises with communities and to strengthen existing once | | | | | | | | | | | | | | | | | | | | |
| 2.5 Initiate local partnership between seed regulators, seed cooperatives/enterprises to register and produce farmers’ preferred varieties seeds derived from Africa RISING project. | | | | | | | | | | | | | | | | | | | | |
| 3. Research questions/hypotheses | | | | | | | | | | | | | | | | | | | | |
| 3.1 What are the key constraints within the vegetable seeds and inputs value chain? | | | | | | | | | | | | | | | | | | | | |
| 3.2 Who are they key actors within the vegetable seeds and inputs value chain in the Northern Sector? | | | | | | | | | | | | | | | | | | | | |
| 3.3 Can women and youth be encouraged as seed producers (out-growers for seed enterprises) to participate actively in the seeds and inputs value chain? | | | | | | | | | | | | | | | | | | | | |
| 3.4 How will the linkages between small holder vegetable farmers and Key seed & other inputs value chain actors can be created or strengthened and how will sustainable linkages be created? | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | | | | | |
| A baseline survey will be conducted in the intervention districts to identify key actors (existing or new) within the vegetable seeds and inputs value chain and their level of functionality. Community forums will be organized at the community level to create a platform for small holder vegetable farmers and key actors in the vegetable value chain to dialogue and to identify various constraints. | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | Responsibility/Institute | | | | | | | | | |
| Is the collected data part of a multi-year experiment/trial? No | | | | | | | | | | |  | | | | | | | | | |
| 5.1 Survey data on various key actors in the vegetable value chain. Data on various constraints within the vegetable value chain. | | | | | | | | | | | WorldVeg | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | Means of verification | | | | | | Delivery date | | | | | | |
| Reports on linkages created (contracts formalized) | | | | | | | | Project report showing number of contracts and quantity of seed delivered (i) by seed enterprises & agro-dealers to beneficiaries, (ii) by female & young outgrowers to seed enterprises (iii) under supervision or involvement of ARI, MoFA (DoA) & NGOs | | | | | | Oct. 2020 | | | | | | |
| Baseline Survey data | | | | | | | | Data from survey in Report and shared on Dataverse | | | | | | Dec. 2020 | | | | | | |
| Community forums organized | | | | | | | | Periodic technical Reports | | | | | | Feb. 2021 | | | | | | |
| Manuals for seed production, water & fertilizer managements (brochures, leaflets, etc.) | | | | | | | | Project reports with number of documents distributed on seed transactions, water & fertilizer managements | | | | | |  | | | | | | |
| Report on women and youth involved in seed & inputs value chain through seed production of key vegetables species | | | | | | | | Interim and Technical Report; contracts | | | | | | May. 2021 | | | | | | |
| Knowledge and information shared | | | | | | | | Forum evaluation form | | | | | | June 2021 | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | **Metrics/Scale** | | **Approach**  **Used In Data Collection** | | | | **Before Intervention** | | | | | | **After Intervention** | | | | | |
| Production | - Seed yield;  -Inputs yield;  -Water use efficiency; | | -kg/ha;  -amount of seed/kg input; amount of seed/m3 | | Record data on seed amount, area covered, water and fertilizers | | | | Available amount of seed /crops (baseline) | | | | | | Available amount of seed /crops (endline) | | | | | |
| 7.1 Social | Gender equity | | Equal Access to information and knowledge within seed & other inputs value chain at plot level | | Group discussions; Forums | | | | - Limited access to seed & other inputs value chain information- No seed & other inputs order previously planned | | | | | | -A platform of actors delivering information  -Number of contract seed farming formalized | | | | | |
| 7.2 Economic | Linkages established for actors of the value chain in UER & NR | | Participation in input and output markets (community, village levels) | | Group discussions; Forums | | | | No or limited market linkages available  -participation in input-output market | | | | | | Market linkages established for vegetables in UER & NR | | | | | |
| 7.3 Human | Capacity to experiment | | Plot level (number of beneficiaries) | | Collect data on beneficiaries involved | | | | Baseline survey | | | | | | End-line survey | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | | | | | |
| Scaling will be done through the involvement of Department of Agriculture (DoA), Women in Agriculture Development (WIAD), Key value chain actors and other NGOs in the implementation of activities. Farmers will be linked to credit institutions and Village Savings and Loans Associations where they can contribute to and access credit to facilitate production. A value chain platform will be created which will be led by The DOA and quarterly meetings will be organized for knowledge sharing. | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | | | | |
| This activity is also linked to nutrition activities Sub activity GHA2121-20: Promote the empowerment of through radio for improved nutrition outcomes. This activity is also linked to the sub-activity implemented by ARI to strengthen the technical, managerial and organizational capacities of the major actors in the small ruminant value chain through existent institutional structures such as Farmer-Based Organizations (FBOs), District Assemblies (DAs), Community Based Organizations, Traders Associations, Transporters and Input Dealers Association. | | | | | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | | | | | |
| * Number of value chain actors trained * Number of farmers attending the sessions organized by the platform disaggregated by sex & age * Number of partnership and market linkages formalized | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Weak relationship between small-holder vegetable farmers and key actors in the vegetable value chain within the Northern sector of Ghana | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | |
| 12. Budget Line (USD) | | | |  | | |  | | | WorldVeg | | | | | |  | | | | |
| Personnel | | | |  | | |  | | | 10,000 | | | | | |  | | | | |
| Services | | | |  | | |  | | | 5,000 | | | | | |  | | | | |
| Supplies | | | |  | | |  | | | 10,000 | | | | | |  | | | | |
| Capital | | | |  | | |  | | | 0 | | | | | |  | | | | |
| Travel | | | |  | | |  | | | 5,000 | | | | | |  | | | | |
| Overhead (10%) | | | |  | | |  | | | 3,000 | | | | | |  | | | | |
| **Total** | | | |  | | |  | | | **33,000** | | | | | |  | | | | |
|  | | | | | | | | | | | | | | | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | **2021** | | | | | | | |
| **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Linkages created (contracts formalized for seed delivery (i) by seed enterprises & agrodealers to beneficiaries, (ii) by outgrowers to seed enterprises (iii) under supervision or involvement of ARI, MoFA (DoA) & NGOs |  |  |  |  |  |  |  |  |  |  |  |  |
| Baseline Survey conducted |  |  |  |  |  |  |  |  |  |  |  |  |
| Community forums organized |  |  |  |  |  |  |  |  |  |  |  |  |
| Women and youth involved in seed & inputs value chain through seed production of key vegetables species |  |  |  |  |  |  |  |  |  |  |  |  |
| Knowledge and information shared |  |  |  |  |  |  |  |  |  |  |  |  |
| Final report submission & data upload in dataverse |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned Work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 3: GH3122-20** | | | | | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | | | | | | | | | | | | | | |
| a. Output 3.1 | | | Output 3.1: Enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners. | | | | | | | | | | | |
| b. Activity 3.1.2 | | | Assess the level of inclusiveness of women and the youth along crops and livestock value chains. | | | | | | | | | | | |
| c. Sub-activity GH3122-20 | | | Assess women and the youth participation in maize and small ruminant value chains in project communities and markets which the communities are linked to | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | | | | Institution | | Role | | | | | | |
| Gundula Fischer | | | | | | IITA | | Social scientist, activity leader, development of tools and data analysis | | | | | | |
| Kipo Jimah | | | | | | IITA | | Gender specialist, development of tools, data collection and data analysis | | | | | | |
|  | | | | | |  | |  | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | Degree | | Start | | End | |
| Nil | | | |  | | | | |  | |  | |  | |
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|  | | | | | | | | | | | | | | |
| f. Location(s) | | Northern Region for livestock value chain and Upper West Region for maize value chain | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | | October 2020 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| In Africa RISING’s first phase, there was less emphasis on the study of value addition to improve the quality of crops and livestock products at the household and market level in Northern Ghana. In the project’s second phase, research on post-harvest activities and value addition have been promoted[[29]](#footnote-29). Adopting a value chain approach, a clear understanding of the actors in crops and livestock systems is needed, especially in terms of their roles and relationships and the distribution of benefits from value chain participation. Such an understanding guides policy makers in developing strategies to improve rural livelihoods.  As Africa RISING continues to support farmers to increase agricultural production through technologies, it becomes more and more important to engage in value chain analysis and to combine it with a gender perspective[[30]](#footnote-30). Available studies from Northern Ghana document differential gender roles in livestock production and ownership (Ansah and Nagbila 2011; Ansah et al. 2015; Baah et al. 2012)[[31]](#footnote-31), but lack an in-depth gender analysis and additional data from non-production actors (traders, veterinarians etc.). For the maize value chain, there is little evidence with gender focus, except for a study by Farnworth and Mahama (2012).[[32]](#footnote-32) The suggested sub-activity addresses the outlined gap and investigates gender and intergenerational relations in the maize and livestock value chains in communities in which Africa RISING is active and in the markets the communities are linked to.  The sub-activity is connected to previous and new gender studies. In 2019, a gender evaluation of the maize cowpea living mulch and maize leaf stripping interventions were conducted. Results provided insights into intra-household decision-making and labor allocation; access to resources as well as benefit sharing among male and female household members. The results relate to the production node of the value chains. Beyond the production stage, research is ongoing on maize shelling machines introduced to farmer groups. In terms of new research, new gender investigations are planned for fertilizer (maize) and fodder cultivation (livestock). All of these studies have a technology focus and will be used not only to analyze relations in the value chains, but also to ask what Africa RISING technologies can potentially contribute to value chain actors’ livelihoods. In order to answer this question men and women respondents from processing and trade will have to be added.  The Africa RISING baseline report (ARBES) shows that maize is the most dominant crop cultivated by farmers in the project target area, the main four crops being maize, rice, groundnut and beans. 91% of the households in the project area cultivate maize with 74% of the produce allocated to own consumption, 11% allocated to sale, 6% saved as seeds and 9% used as a means of exchange. In the case of livestock, poultry is raised in 90% of the households. 72% keep local goats and 48% keep sheep.[[33]](#footnote-33) For this reason, the proposed research will focus on the maize and small ruminant value chains. The research will adopt both quantitative and qualitative approach to assess the level of inclusiveness of women and the youth in maize and small ruminant value chains and to reveal the effects of social norms that create inequalities within and across the two value chains. The livestock study will focus on the Northern Region, while the maize study will be implemented in the Upper West. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 To assess women, men and youth’ participation in and benefits from maize and small ruminant value chain activities in the project communities | | | | | | | | | | | | | | |
| 2.2 To capture social norms and institutions that promote or hinder equitable value chain participation and benefits | | | | | | | | | | | | | | |
| 2.2 To inform discussions and decisions on gender-responsive strategies and practices that will facilitate and increase the inclusiveness of women and the youth in maize and small ruminant value chains | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What are the differential labor roles, benefits and entry requirements for women and men (including age differences) with regard to the maize and small ruminant value chains? | | | | | | | | | | | | | | |
| 3.2 What are the inequitable social norms and institutions that could be addressed by gender-transformative approaches? | | | | | | | | | | | | | | |
| 3.3 What will facilitate women and the youth participation in maize and small ruminants value chains? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| The study will use both qualitative and quantitative methods. A gendered value chain appraisal tool developed by Mutua et al. (2014)[[34]](#footnote-34) for focus group discussions will be combined with a gender transformative approach (Kruijssen et al. 2016)[[35]](#footnote-35) and a short concomitant survey. For the livestock value chain we will conduct 10 FGDs (5 with women, 5 with men) in the Northern Region. In the Upper West Region we will conduct 12 FGDs (6 with women, 6 with men). | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | | Responsibility |
| 5.1 Quantitative data collected and uploaded to Dataverse | | | | | | | | | | | | | | IITA |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | End date | | | |
| 6.1 Clean data files for analysis | | | | | | | Transcriptions and excel files | | | | June 2021 | | | |
|  | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | | | **Metrics/**  **Scale** | | **Approach**  **Used In Data Collection** | | | **Before Intervention** | | **After Intervention** | | |
| 7.1 Productivity |  | | | |  | |  | | |  | |  | | |
| 7.2 Environmental |  | | | |  | |  | | |  | |  | | |
| 7.3 Economic |  | | | |  | |  | | |  | |  | | |
| 7.4 Social | * Market participation * Income * Labor | | | | * Household * Market | | * Survey * FGDs * Participatory exercises (gender norms) | | | Not applicable | | Not applicable | | |
| 7.5 Human |  | | | |  | |  | | |  | |  | | |
|  | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | |
| The findings of the study will inform discussions and decisions on gender-responsive strategies and practices to be chosen for value chain interventions. The results of these processes will be communicated to development partners for further use. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | |
| The activity in this protocol is linked to activities under outcome 3, improved policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets.  This study links to the following other work plan activities (see above): | | | | | | | | | | | | | | |
| * Work plan Addah Wesseh leaf stripping (GH1123-20) * Work plan Terry Ansah fodder cultivation (GH1113-20) * Work plan Ayantunde Augustine feed troughs (GH1121-20) | | | | | | | | | | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| * Work plan Bekele Kotu maize shellers (GH2212-20) * Work plan Nurudeen Abdul Rahman fertilizer (GH1112-20) | | | |
| 10. Custom indicators | | | |
| * Technical report on opportunities, constraints and needs of women and the youth participation in maize and small ruminants value chains | | | |
|  | | | |
| 11. Impact-based summary matrix | | | |
| 11.1 What is the development challenge you are addressing?  Women and the youth play important roles in all stages of crops and livestock value chains. However, because they are largely not household heads, their contribution as well as enjoying the benefits of participating in value chains is limited. The study will provide an understanding of the roles, responsibilities and relationships between women, men (including young men and women) in maize and small ruminants value chains, and the distribution of the benefits of engaging in maize and small ruminants which is crucial for policy makers in developing strategies to improve rural livelihoods. | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers, traders, extension agents, policymakers, development actors. | | | |
|  | | | |
| 12. Budget (US$) | | | |
| **Budget Line** | **IITA** |  |  |
| Personnel | 1,658 |  |  |
| Services (including training of enumerators) | 418 |  |  |
| Supplies | 477 |  |  |
| Capital |  |  |  |
| Travel | 1,947 |  |  |
| Overhead |  |  |  |
| **Total** | 4,500 |  |  |

13. Gantt Chart

|  |  |
| --- | --- |
| **Year/ Month** | **2020-21** |
| **Oct 2020** | **Nov 2020** | **Dec 2020** | **Jan 2021** | **Feb 2021** | **Mar 2021** | **Apr**  **2021** | **May**  **2021** | **Jun 2021** |
| Tool development |  |  |  |  |  |  |  |  |  |
| Facilitator training |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |
| Data processing/analysis |  |  |  |  |  |  |  |  |  |
| M&E for verification |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned Work** | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 3: GH3211-20** | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | | | | | | | | | | | | | |
| a. Output 3.2 | | | Options to increase access to production assets and increase participation in decision-making by women, youth and other vulnerable groups. | | | | | | | | | | |
| b. Activity 3.2.1 | | | Identify constraints to, and opportunities for increasing women and youth access to production assets in the target area. | | | | | | | | | | |
| c. Sub-activity GH3211-20 | | | Evaluate risk and vulnerability as well as resilience attributed to Africa RISING interventions within smallholder farming systems in relation to wellbeing and livelihoods. | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | |
| **Name** | | | **Institution** | | | | **Role** | | | | | | |
| Fred Kizito | | | IITA | | | | PI: Land and water management | | | | | | |
| Wilson Agyei Agyare | | | KNUST | | | | Co-PI: Soil and water management | | | | | | |
| B. O. Antwi | | | Soils Research Institute | | | | Soil and water management support | | | | | | |
| Abdul Rahman Nurudeen | | | IITA | | | | Cereal agronomy and plant nutrition analysis | | | | | | |
| Bekele Kotu | | | IITA | | | | Economics assessments support | | | | | | |
| Gundula Fischer | | | IITA | | | | Gender and social aspects support | | | | | | |
| Benedict Boyubie | | | IITA | | | | FtF indicators, ensure data upload on Dataverse | | | | | | |
|  | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | |
| Name | | Institute | | | | Degree | | | | Start | | | End |
| Ernestina Anan | | KNUST | | | | MPhil | | | | 2018 | | | 2020 |
|  | | | | | | | | | | | | | |
| f. Location(s) | Northern (Tingoli, Cheyohi no. 2, Doku, Tibali); Now covering Upper West, Upper East, North East, Northern and Savannah Regions | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| g. Start | Aug 2019 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| h. End | Apr 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | |
| The sub-activity GH1212-20 looks at assessing the impact of soil and water conservation interventions in a maize-cowpea living mulch system. The sub-activity GH3211-20 complements GH1212-20 in that it evaluates the risk and vulnerability as well as resilience within the maize-cowpea living mulch systems. The proposed sub-activity GH3211-20 explores a wider view beyond cowpea living mulch (as proposed in GH3211-19) and assesses smallholder farmers’ livelihoods in relation to several other Africa RISING interventions e.g. groundnut spacing, maize leaf stripping, as well as soil and water conservation. This is in light of the major stressors and shocks that smallholder farmers are continuously exposed to. This allows us to explore risk and resilience issues within farming systems and how these can inform us on options towards reducing vulnerabilities of smallholder farmers while increasing their livelihood opportunities. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | |
| 2.1 Evaluate risk and resilience within maize-cowpea living mulch in relation to smallholder farmers’ livelihoods. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 3. Research Questions | | | | | | | | | | | | | |
| 3.1 How would evaluation on risk and resilience issues within Africa RISING interventions in smallholder farming communities inform on reducing vulnerabilities of smallholder farmers and increase their livelihood opportunities? | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.). | | | | | | | | | | | | | |
| The team explored effective, measurable resilience-building strategies, this involved considering the complex interactions that exist between risks, people and the socio-ecological systems in which they live. These interactions occur at various spatial and temporal scales and are inherently dynamic. Thus, when shocks hit a system, they do not occur in isolation; rather, they interact with multiple factors that can compound their impact and provoke downstream effects. Understanding social-ecological systems, for instance, requires understanding how people think, engage with one another and their environment, and react to and affect changes from the local level to the community, regional and national level. For this sub-activity, we principally considered the local to community levels and used biophysical and ecological modeling, focused group discussions and economic tools as well as the SIAF to allow for a systems approach to tease out farming dynamics.  This sub-activity followed USAID’s resilience guidance notes[[36]](#footnote-36) and entailed 4 steps:  Step 1: Planning and design in order to determine the purpose (how will this analysis be used, by whom), scope and scale of the assessment as well as the level of effort while taking stock of existing data, identifying knowledge gaps and creating a research plan to respond to key questions on resilience capacities and risks. This will be followed by:  Step 2: Data Collection which entailed qualitative and quantitative data from primary and/or secondary sources to fill knowledge gaps identified in Step 1.  **To be conducted in 2020:**  Step 3: Analysis. Combine and interpret data to answer key questions as determined in Step 1.  Step 4: Strategic Planning. Translate findings into appropriate outputs, based on the purpose of the assessment. Possible outputs include resilience-building programmatic strategies. In order to measure absorptive, adaptive and transformative capacities of resilience at the household and community scales, we intend to link aspects of resilience to the SIAF at the aforementioned scales | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | Responsibility/Institute | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | | |  | |
| 5.1 For resilience:  We shall focus on primary qualitative and quantitative data at a high level of spatial resolution supported by secondary data and external studies; in order to measure absorptive, adaptive and transformative capacities of resilience at the household and community level. We intend to link aspects of resilience to the SIAF at both scales; sample data sets will include human well-being data and livelihood data from surveys as well as biophysical data on weather/climate. | | | | | | | | | | | | F. Kizito/IITA and E. Annan/KNUST | |
| 5.2 Co-share with end-user’s adaptation and resilience insights:   * Resilience Assessment Level of Effort Matrix * Risk and vulnerability qualitative data from FGDs (focus group discussion) and Key Informant Interviews * Knowledge, Attitude, Skills and Aspirations (KASA) analysis | | | | | | | | | | | | F. Kizito/IITA and the team | |
|  | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | |
| Deliverables | | | | | Means of verification | | | | | | | Delivery date | |
| 6.1 Synthesis on resilience in smallholder legume farming systems in the context of land and water management strategies | | | | | Semi-annual technical report | | | | | | | Feb. 2021 | |
| 6.2 Journal article on Resilience | | | | | Journal Article | | | | | | | Dec. 2020 | |
|  | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | | **Metrics/Scale** | | | | **Methods/Approaches taken including duration** | | | **Before intervention** | | **After intervention** |
| 7.1 Productivity | Crop productivity | | | Yield (kg/ha/season) at the field/plot level | | | | Agronomic trials (See GH111-19) for 2017, 2018 and 2019 | | |  | |  |
| 7.2 Environmental | -Erosion  -Soil water storage | | | -Soil loss (tons/ha/season) at the plot level  - Seasonal soil moisture storage mm/m | | | | - Field measurements  - Modelling with SWAT and APEX | | |  | |  |
| 7.3 Economic | - Profitability  - Input Use Intensity | | | - Net income ($/crop/ha/season) at the plot level  - Input per ha at the plot level | | | | Econometric analysis based on productivity data (combined both maize and cowpea productivity data) | | |  | |  |
| 7.4 Social | - Gender equity  - Collective action | | | -Capacity: Access to information (Household)  - Participation in a collective action group (Household) | | | | Surveys and FGDs using direct engagements and electronic tools (Insyt and Kobo Collect) | | |  | |  |
| 7.5 Human | Capacity to experiment | | | - Number of new practices being tested (Household level)\  - % of farmers experimenting (Community level) | | | | Surveys and FGDs | | |  | |  |
|  | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | |
| We shall liaise with MoFA, from the private sector with specifically WorldCover and local universities. We also intend to liaise and engage closely with Texas A&M on work towards modeling resilience of systems using both current and legacy data products. This will allow us to reach broader audiences and publish our work. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | |
| The activities are related to sub-activities GH1111-20 and GH1212-20. This is an integrative activity in that IITA and KNUST will collaborate on soil and water conservation incorporation within farming systems. The resilience aspects emphasized in this work plan will be complementary to the work proposed by WUR and vice versa. The IITA component will rely heavily on an approach promoted by USAID[[37]](#footnote-37) complemented with field measurements while the WUR will rely on modeling and farming typologies. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | |
| * Synthesis: Resilience in cereal-legume farming systems in the context of land and water management strategies * Knowledge, Attitude, Skills, Aspirations Analysis * Journal artcile | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  If communities are not resilient, they remain exposed and vulnerable. Through this research, the sub-activity will seek information about the vulnerabilities and resilience capacities of the target communities and how this contributes towards reducing food insecurity and poverty and enhance the natural resource base. | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Smallholder farmers, agricultural extension agents, donors (USAID) and policymakers. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 12. Budget | | | | | | | | | | | | | |
| **Budget line item** | | | **IITA** | | | | | | **KNUST** | | | | |
| Personnel | | |  | | | | | | 3,000 | | | | |
| Services | | | 4,000 | | | | | | 600 | | | | |
| Supplies | | | 3,000 | | | | | | 700 | | | | |
| Capital | | | 1,000 | | | | | | 1,000 | | | | |
| Travel | | | 2,000 | | | | | | 700 | | | | |
| Overhead | | | 0 | | | | | | 600 | | | | |
| **Total** | | | **10,000** | | | | | | **6,600** | | | | |
| **Grand total** | | | **16,600** | | | | | | | | | | |

13.Gantt Chart

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | **2021** | | | |
| **Jul** | **Aug** | **Sep** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Training |  |  |  |  |  |  |  |  |  |
| Refining elements |  |  |  |  |  |  |  |  |  |
| Finalizing content\* Includes support to other Book Chapters |  |  |  |  |  |  |  |  |  |
| Stock of existing data |  |  |  |  |  |  |  |  |  |
| Identification of knowledge gaps |  |  |  |  |  |  |  |  |  |
| Plan on resilience/risk capacities |  |  |  |  |  |  |  |  |  |
| Assessment of Africa RISING SI technologies |  |  |  |  |  |  |  |  |  |
| KASA Analysis |  |  |  |  |  |  |  |  |  |
| Analysis and strategic insights |  |  |  |  |  |  |  |  |  |
| Link resilience to cropping calendar |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | | | |
| **2020 Africa RISING W. Africa Activity Protocol – Outcome 3: GH3212-20** | | | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | | | | | | | | | | | | |
| 1. Output 3.2 | | Options to expand accessibility of production assets and increase participation in household decision-making by disaggregated groups by gender.. | | | | | | | | | | |
| 1. Activity 3.2.1 | | Identify constraints to, and opportunities for increasing women and youth access to production assets in the target area. | | | | | | | | | | |
| 1. Sub-activity:3212-20 | | Co-identify value chain-based scaling pathways for irrigation technologies and water solutions with farmers and other actors of vegetable value chains in the Africa RISING sites in Mali and Ghana and link these sites and activities to ILSSI’s multi-stakeholder Dialogue Space on small scale irrigation in Ghana | | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | Institution | | | Role | | | | | | | |
| Thai Minh | | IWMI | | | The Senior researcher will be responsible for the systemic analysis of the scaling pathway for irrigated vegetable value chain in Ghana and Mali. She will carry out data collection and analysis on SI indicators mainly on social and human condition to evaluate holistic sustainability of the interventions | | | | | | | |
| National Researcher Scaling Innovations (TBD) | | IWMI | | | The National Researcher will support the data collection on the systemic analysis component. | | | | | | | |
| Jean Baptiste Tignegre | | World Veg | | | Contribution on vegetable value chain | | | | | | | |
| Benedict Boyubie | | IITA | | | Support towards meeting project M&E requirements and FtF indicators while ensuring data upload on Dataverse | | | | | | | |
| Birhanu Zemadim | | ICRISAT-Mali | | | Contribution on sub-activity conducted in Mali | | | | | | | |
| Adams Abdulai | | STEPRI | | | Contribution to value chain stakeholder analysis | | | | | | | |
|  | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | |
| Name | | | Institute | | | | Degree | | Start | | End |
|  | | |  | | | |  | |  | |  |
|  | | | | | | | | | | | | |
| f. Location(s) | National Level in Ghana and Mali; link to ground level activities in Upper East Region, Ghana | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | September 2020 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | May 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **1. Justification** | | | | | | | | | | | | |
| Farmer investment in irrigation conforms to value chain logic as it has dependency on income from the sale of irrigated crops for re-investing in irrigation and inputs (pumps, fertilizers, improved seeds, pesticides) in order to raise productivity (Adela et al., 2019; de Bont et al., 2019 and 2019a). Irrigation technology supply and services as well as access to well established and profitable output markets need to collide for farmers to see the value of investing in irrigation for their production system. Access to output market for agricultural products is a major factor determining farmers’ adoption of irrigation technologies. To support systemic scaling of technologies, it is essential to conduct an irrigated value chain analysis.  Specifically, the value chain analysis aims at understanding primary products and production-related factors to enhance sustainable production systems, market structure for agricultural products be produced and marketed in the chain, and the chain structure. The production system analysis emphasizes primary resources required for production, environmental consequences of resource exploitation, primary productivity, potential incomes generated for primary producers, and factors facilitating and inhibiting the production (Herman and Minh, 2020). The market analysis provides understanding of market demands and requirements for products to be successfully produced and marketed in the chain. The chain structure analysis investigates the chain’s functions, potential actors’ roles and relevant knowledge and experience, value addition and distribution, and governance to determine how to organize the chain. Within the systemic scaling approach, irrigated value chain analysis can generate a better understanding of the level of entrepreneurship, gender, and social inclusion barriers to entrepreneurship and the mechanisms by which scaling of appropriate irrigation technology can be better integrated into the value chains.  Currently, IWMI is implementing several related initiatives on co-identification of value chain scaling pathway to operationalize the systemic scaling approach at the grassroots level. These works have been done under the scope of Africa RISING project in Ethiopia. In Ghana, ILSSI has established and facilitated multi-stakeholder dialogues around scaling of small scale irrigation. Leveraging on ongoing projects’ efforts, IWMI proposes the research on contextualizing the systemic scaling for irrigation technologies in respect of relevant AR-specific value chains in targeted region or district in Mali and Ghana and linking these activities with ILSSI multi-stakeholder dialogues (in Ghana) to foster interactive learning among stakeholders and accelerate the impact of scale. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **2. Objectives** | | | | | | | | | | | | |
| 2.1 Understand value chain-based scaling potentials for irrigation technologies and water solutions along irrigated vegetable value chains | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **3. Research questions** | | | | | | | | | | | | |
| 3.1. How the systemic scaling of irrigation technologies and water solutions can be injected in agricultural value chains for sustainable intensification? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.)** | | | | | | | | | | | | |
| An action research approach will be used for research on Bhungroo and solar-based energy under the different drip irrigation system (GH1222-2), enabling environment, and value-chain-base scaling pathway for irrigation technologies. The action research consists of four interrelated steps: analyse, co-design and test, reflect and act, and engage. The **analysis step** includes a rapid assessment by an inter-disciplinary team from IWMI, using various methods such as semi-structure interviews with farmers and value chain actors, focus groups discussion with farmers, Water User Association, cooperative and cooperative union, in a combination with field observation and transaction walks, and consultation workshops with local relevant stakeholder. The assessment aims to:   * Investigate existing irrigation technologies and practices and farmers’ interests and willingness to adopt, * Understand irrigated value chain structure and function, * Investigate irrigation supply and output market, * Characterize the enabling environment at the local level, and * Identify technology opinions and scaling pathways.   In the **co-develop** step, stakeholder consultation workshops on scaling of water innovation within irrigated agricultural value chain will be organized to:   * Explore further the challenges, technology and scaling options/possibility, * Co-design technology demonstration with farmers (activity **GH1222-2**) * Explore possibilities to scale the demonstrated irrigation practices/technology to other irrigation schemes within community, from one community to other communities, and from one district to others, * Investigate conditions for successful scaling of irrigation practices, * Identify key value chain actors to be involved to enhance the successful scaling and how to involve them, * Identify local partners for collaboration in the scaling of water innovations, and * Plan the implementation of the demonstration and scaling possibilities with stakeholders.   The **reflect step** will be undertaken by the research team throughout the testing process to:   * Gather and analyze feedbacks from farmers and partners participating in the testing of demonstration and scaling pathways and integrating them into adapting the tested pathways, * Reflect on tested technologies and scaling pathway, how to continue with the tested scaling pathway, how local partners and participants appreciate the scaling approach, and how they react to it, * Incorporate these reflections into the new scaling pathways to be tested in the future, and * Prepare for the further stakeholder engagement process (see the next step).   The **engage step** will also be carried out throughout the action research process, aiming to interact with stakeholders and participants of the testing process, engage with the existing innovation platforms and multi-stakeholder dialogues at local and national level, and identify and involve new relevant actors and stakeholders. Specific activities in the engage step include, but not limited to:   * Organize technology awareness campaigns in the villages together with development agents, department/office of agriculture at district and regional levels and NGOs; * Link Africa Rising’s scaling pilots with ILSSI multi-stakeholder dialogues around SSI; * Engage private sector in demonstrating and supplying technologies within the communities; and * Share experience and lessons learnt with the district/regional/and national relevant multi-stakeholder platforms. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **5. Data to be collected and uploaded on Dataverse** | | | | | | | | | **Responsibility** | | | |
| * Vegetable value chain’s actors, their roles, and their relationships in the chain * Activities carried out by actors * Local input supply systems * Farmers’ production system and marketing channels * Local collection/trading systems * Vegetable market structure, demand and supply, opportunities, and trends * Private sector actors involving in supplying of irrigation equipment and water solutions * Irrigation technology and water solutions for scaling   Scaling options for Irrigation technology and water solutions | | | | | | | | | IWMI | | | |
| **6. Milestones** | | | | | | | | | | | | |
| **Deliverables** | | | | | **Means of verification** | | | | **End date** | | | |
| 6.1 Qualitative dataset on technology and scaling option and vegetable value chains in Ghana and Mali | | | | | Dataverse | | | | June 2021 | | | |
| 6.2 Report on the technology and scaling pathways co-identified two AR sites in Ghana and Mali | | | | | Project report to be published in CGSpace submitted to IITA | | | | July 2021 | | | |
| 6.3 Paper based on this year’s data and research on systemic scaling of irrigation technologies and water solutions along irrigated value chains | | | | | Correspondence with Journal about submission | | | | July 2021 | | | |
|  | | | | | | | | | | | | |
| **7. Sustainable intensification indicators (Still need help here)** | | | | | | | | | | | | |
| **Domain** | **Indicator** | | | **Metrics/Scale** | | **Approach used** | | **Before intervention** | | **After intervention** | | |
| 7.3 Economic | Income increase from selling irrigated products | | | Amount increased per dry season | | Interviews | |  | |  | | |
| 7.4 Social | Gender equity | | | Rating of technologies by gender-friendliness at household level | | Interviews | |  | |  | | |
| 7.5 Human | Food security | | | Food consumption from irrigated products | | Interviews | |  | |  | | |

|  |  |
| --- | --- |
| **8. How will scaling be achieved?** | |
| Scaling will be achieved by series of stakeholder engagement and system scaling activities, including, but not limited to:   * Using co-generation of knowledge through on-farm demonstration to scale out innovative technologies; * Organizing stakeholder meetings with farmers and extension officers on the results of the trials and the preferred water lifting and application methods during the dry season; * Sharing research results and engaging with potential scaling partners such as regional offices of Ministry of Food & Agriculture (MoFA) and GIDA (Ghana Irrigation Development Authority), the Agriculture Sector Working Group (ASWG) once the technologies and scaling pathways are co-identified and verified; * Linking AR’s irrigation technology and value chain-based scaling pilots with relevant multi-stakeholder dialogues/platforms to integrate the scaling into the platforms’ agendas and to facilitate the systemic changes and capacity to enhance the scaling of irrigation technologies and water solutions * Developing and using fact sheets, workshops, policy briefs, as well as scientific papers to communicate to the wider public actors, practitioners and relevant stakeholders. | |
| **9. How are the activities in this protocol linked to those of others?** | |
| This sub-activity experiment is linked to other work conducted by IWMI on water use within vegetable production systems. In addition, it is linked to sub-activities planned by the World Vegetable Centre under GH11.15-21 and GH1116-21. And by STEPRI on policy and institutional analysis. The outcomes of this research will help to disseminate irrigated vegetable production in the Upper East Region of Ghana and other similar areas in Ghana and beyond. | |
| **10. Custom indicators** | |
| * Number of demonstrations established * Number of farmers trained * Number of field days organized * Number of meetings/workshops attended * Number of project reports produced * Number of 1 journal article submitted/published | |
| **11. Impact-based summary matrix** | |
| 11.1 What is the development challenge you are addressing?  This sub-activity will address the following major development challenges:   * highly vulnerable to the effects of climate change, while farmers are cultivating in marginal lands with low and erratic and are exposed to more frequent and longer dry spells and floods that threaten food security. * Social and gender norms hindering social inclusion, together with limitation in the physical environment obstruct the investment and expansion of irrigation. * Along the agricultural value chain, constraints to smallholders’ access to water management technologies and equipment as well as investment to irrigation include, but not limited to, under-developed irrigation value chains and capacities, under-developed irrigation supply chain, limited access to finance, energy, knowledge services to invest in irrigation, and weak input and output market linkages; * Government policies and programs are biased towards large-scale irrigation and production system and lag behind efforts of smallholder farmers and the private sector in AWM;   11.2 Who is your target audience, e.g. extension agents, farmers, or policy makers?  The most important audience include small-scale farmers, women and youth involving in farming, extension and development agents, policy makers and private sector who are working on irrigation and solar-powered products. | |
|  | |
| \*\*\*12 Budget: This budget is for both Ghana and Mali, thus the sub-activity has been replicated in Mali with no budget figures appended to the workplan. | |
| **12. Budget Line** | **IWMI** |
| Personnel | 45,114 |
| Services | 7,060 |
| Supplies |  |
| Capital |  |
| Travel | 28,073 |
| Overhead | 17,908 |
| **Total** | **98,154** |

**13. Gantt Chart**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2020** | | | | **2021** | | | | | | | |
| **Year/ Month** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Co-identify scaling pathways(incl. vegetable value chain analysis, farmer engagement, need assessment, training ) |  |  |  |  |  |  |  |  |  |  |  |  |
| Facilitating local stakeholders to carry on the value chain-based scaling pathways |  |  |  |  |  |  |  |  |  |  |  |  |
| Multi-stakeholder dialogues and engagement |  |  |  |  |  |  |  |  |  |  |  |  |
| M&E for verification |  |  |  |  |  |  |  |  |  |  |  |  |
| Reflection, data analysis and report writing |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4111-20** | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | | | | | | | | | | | | |
| a. Output 4.1 | | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | | | | | | | | | | | | |
| b. Activity 4.1.1 | | | Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts. | | | | | | | | | | | | |
| c. Sub-activity GH4111-20 | | | Conduct representative technological pathway analysis on adoption of technologies taking various socioeconomic and biophysical dimensions into consideration | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | | | | Institution | | | Role | | | | | | |
| Adams Abdulai (Economist) | | | | | | CSIR-STEPRI | | | Lead (Research design, analysis and reporting) | | | | | | |
| Adelaide Agyeman (Statistics/Gender) | | | | | | CSIR-STEPRI | | | Gender Specialist | | | | | | |
| Nana Yamoah (Agricultural Economist) | | | | | | CSIR-STEPRI | | | Data analysis and reporting | | | | | | |
| Livingston Caesar (Business Management) | | | | | | CSIR-STEPRI | | | Data management and reporting | | | | | | |
| Emmanuel Tetteh Jumpah (Agricultural Economist) | | | | | | CSIR-STEPRI | | | Research design, data analysis and reporting | | | | | | |
| Benedict Boyubie | | | | | | IITA | | | Compilation of FtF indicators and ensuring data upload on Dataverse | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | Degree | | Start | End | | |
| NILL | | | |  | | | | | |  | |  |  | | |
|  | | | |  | | | | | |  | |  |  | | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | | Upper West, Upper East, North East, Northern and Savannah Regions | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | September 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | August 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| The Africa RISING program is a key pathway towards better food security, improved livelihoods, and a healthy environment. There is widespread recognition that new pathways and scenarios are needed in the assessment of impact of technology adoption and vulnerability of smallholder farmers across local, regional, and global scales (Valdivia et al., 2013[[38]](#footnote-38)). Various technologies have been developed and validated by IITA in Ghana (Ghana Country brief, 2019[[39]](#footnote-39)) but the compliments of pathways for these technologies are missing for future predictions of adoption pathways. Developing representative technological pathways is therefore important.  Since 2017, STEPRI has been involved in the implementation of activities that contribute mainly to outcomes 3 and 4. So far, work has been done to analyze farmers’ access to input and output markets, delivery pathways for SI technologies and the role of government extension services, review of agricultural mechanization policy ordinances in Ghana, and simulation analysis on SI technology adoption. A deeper reflection of the activities carried out has revealed some gaps in implementation. Some of the key gaps identified includes:   * Limited dissemination of research findings with farmers and middle level decision making institutions (Business Advisory Centres, District Assemblies, District/Regional Directorates of MoFA, etc.). * Weak gender disaggregation of data on farmers‘ decisions to adopt the SI technologies demonstrated. * A disconnect between fertilizer trials currently being conducted on the field (by Nurideen) and policy makers to help integrate fertilizer trial information into policy decisions on the type of fertilizer blends to adopt under the fertilizer subsidy program of the government (Planting for Food and Jobs). * Some planned activities under the simulation analysis on SI technology adoption (preparation of 2 manuscripts and a policy brief by August 2021 for publication) are yet to be fully delivered.   It is, therefore, important to deepen stakeholder engagements at various levels (local, regional, and national) based on the results achieved to help consolidate gains made on outcome 3 and 4 on the activities carried out. This sub-activity is a continuation of work that was started in 2019 and builds on these efforts to ultimately generate a Journal article. Undertaking additional analysis on representative technological pathways and gender-disaggregated analysis on farmer adoption decisions using the available data sets will go a long way to address the observed weaknesses in activities implementation. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 To determine best adoption pathways for different farmer typologies and SI technologies. | | | | | | | | | | | | | | | |
| 2.2 Create awareness at the community and district/regional levels on the research findings (market access and technology adoption from the simulation analysis) for scale up by actors and other stakeholders. | | | | | | | | | | | | | | | |
| 2.3 Undertake gender analysis in relation to technology adoption to inform policy. | | | | | | | | | | | | | | | |
| 2.4 Increase visibility of the Africa RISING intervention through policy engagements and use of available platforms (such as FARA data informS) and the Agriculture Sector Working Group (ASWG) to disseminate widely research findings based on the SI framework. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 Which SI technology adoption pathways can best be recommended for adoption by farmers practicing various technologies? | | | | | | | | | | | | | | | |
| 3.3 How can middle level decision makers at the district and regional levels be involved in implementing policies that support the participation of smallholders in input and output markets? | | | | | | | | | | | | | | | |
| 3.4 What is the level of inclusiveness of women and youth along crop and livestock value chains, input and output markets, as well as adoption patterns for the various technologies demonstrated? | | | | | | | | | | | | | | | |
| 3.5 How can the results, key research findings, recommendations, and lessons leant from the AR initiative be made known to stakeholders at various levels for scaling up efforts and decision making? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| 4.1 Data of two rounds of household surveys in 2018 and 2019 will be used for the current study. Data sets will be extracted and used for the representative technological pathway as well as the gender analysis. Secondary data from Africa RISING validated technologies of interest (maize-cowpea intercropping, time of fertilizer application, cowpea living mulch, and maize leaf stripping) will be assembled to aid the representative technological pathway analysis.  Identification of indicators in the technologies will be done based on social, economic and biophysical dimensions.  Economic indicators to capture include costs of ploughing, planting, spraying harvesting, storage, the price per kilo of produce, the price per livestock output, and quantity of produce harvested per hectare. The social indicators will include off-farm income, average household size, herd size for all livestock, and poverty line (GHS/person/time). Biophysical indicators of interest include quantity of seeds, fertilizers, pesticides, and herbicides. Since technology adoption involves a dynamic process of information gathering and learning, farmer characterization and experience is central in the analysis.  The analytical framework outlined by Valdivia et al. (2013) for Representative Agricultural Pathways and Scenarios (RAPS) and the DevRAPS tool developed by Valdivia and Antle (2012)[[40]](#footnote-40) will be adapted and a stepwise procedure followed for the analysis. Trend directions and magnitudes will define the change in the indicators as well as the percentage change for each indicator respectively. The outcome of the change could be no change, small change, moderate change, or large change. Quantitative modeling through simulation of the various technologies will be done to harness insights generated on adoption impact pathways.  Policy engagements /dialogues with stakeholders (MoFA, input dealers, traditional authorities, District Assemblies, RELC, Agricultural Sector Working Group, Peasant Farmers Association,etc.) will be organized to discuss the research findings and help ease barriers to technology adoption by farm households. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | | | Responsibility |
| Is the collected data part of a multi-year experiment/ trial? Yes | | | | | | | | | | | | | | |  |
| No new data will be collected. Only data drawn from secondary sources will be utilized | | | | | | | | | | | | | | |  |
| 5.1 Extracted data for representative pathway analysis | | | | | | | | | | | | | | | STEPRI/IITA |
| 5.2 Extracted data for gender analysis | | | | | | | | | | | | | | | STEPRI/IITA |
| 5.3 Data collected through stakeholder policy engagements | | | | | | | | | | | | | | | STEPRI/IITA |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | End date | | | |
| 6.1 Summarized synthesis of representative pathway analysis results (quantitative) of impacts of selected SI technologies adoption. | | | | | | | Technical reports  Policy brief  Journal articles | | | | | November 2020 | | | |
| 6.2 Knowledge sharing events at the community and district/regional levels. | | | | | | | Reports fliers, leaflets  Media engagements | | | | | March 2021 | | | |
| 6.3 Insights in gender response to SI technology adoption and market access. | | | | | | | Technical report  Facts sheet | | | | | September 2021 | | | |
| 6.4 Stakeholder policy engagement events and synthesis of the proceedings. | | | | | | | Policy dialogue reports  Policy briefs  Media engagements | | | | | July 2021 | | | |
| 6.5 Contribution to West Africa Handbook | | | | | | | Book publication | | | | | August 2021 | | | |
|  | | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | | | **Metrics/Scale** | | | **Methods/Approaches taken including duration** | | | **Before intervention** | | | **After intervention** | |
| 7.1 Productivity | Crop productivity | | | | Yield (kg/ha) at the field level | | | Household survey | | | Low productivity | | | 87.2% indicated improved productivity | |
| 7.2 Environmental | Soil erosion, Pesticide use | | | | Soil loss (tons/ha/year), Rating of erosion, Active ingredients applied per ha | | | Household survey | | | High erosion rates reported | | | Low rate of erosion incidence experienced by farmers | |
| 7.3 Economic | Profitability | | | | Profit and income at household level | | | Household survey | | | Low per capita and farm incomes | | | 73.1% indicated that adoption leads to improved incomes | |
| 7.4 Social | Social cohesion | | | | Collective action at community level | | | FGD, KII | | | Low social cohesion and gender equality (20.1%)  Exclusion of vulnerable groups | | | Improved social cohesion  8.8% of vulnerable groups covered by the intervention | |
| 7.5 Human | Capacity to experiment and innovate | | | | Number of farmers experimenting with nutrition technologies at the household level | | | Household surveys, FGD | | | Members have low bargaining skills. | | | Members have skills to opt for and use other market channels.  65.8% indicated improved agricultural practices. | |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| The findings of our study will be beneficial to Africa RISING communities, partners, and policymakers interested in promoting technology adoption and gender for inclusiveness, increased incomes, and productivity. It will highlight the impact of technological pathways relating to maize-cowpea intercropping, cowpea living mulch, the timing of fertilizer application, maize leaf stripping and stimulate wider adoption of these technologies in the future. Results of the evidence-based research conducted on farmers’ access to markets and technology adoption simulation will be presented at the community and district levels. This will not only deepen the knowledge of local actors on what has been achieved by the Africa RISING project but will also highlight institutional barriers that local actors can ease for wider adoption and improved well-being of people in the communities. The results of this study will be presented and discussed at workshops, conferences, and policy dialogues for policymakers’ support. Available knowledge management platforms (such as FARA data InformS) will be used to disseminate widely policy briefs, leaflets, fact sheets etc. to inform different stakeholders about lessons learned from the intervention. Journal articles will also be prepared and published. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| The proposed activity is directly linked to three other sub-activities (mainly within Outputs 1 and 2) being implemented under the Africa RISING program. First, it draws on the crops/productivity work being done by IITA sub-activity GH1111-20. Secondly, it is directly linked to the mechanization sub-activity GH221-1901 being done by IITA, and finally on the crop/livestock activities being implemented by ILRI and ARI in northern Ghana sub-activity GH3111-20. The activity also extends and builds on previous work done by STEPRI on market access and technology adoption simulation (outputs 3 and 4) by undertaking gender-disaggregated analysis using the available data to inform policy. Certainly, this is expected to enrich policy discussions and improve the decision making of households regarding which technological pathways will likely yield positive impacts on their livelihoods for adoption. | | | | | | | | | | | | | | | |

|  |  |
| --- | --- |
|  | |
| 10. Custom indicators | |
| * Number of community engagements/policy dialogues held * Number of technical leaflets, fact sheets, and policy briefs produced * Number of journal articles submitted/published | |
|  | |
| 11. Impact-based summary matrix | |
| 11.1 What is the development challenge you are addressing?  In Ghana, low adoption of modern agricultural production technologies amongst farmers has been identified as one of the main reasons for the low agricultural productivity in the country. The factors that influence the adoption of modern agricultural production technologies are related to economic, social, and institutional factors. Increasingly, the adoption of technologies by farmers is on a growth trajectory among smallholder resource-poor farmers in northern Ghana. However, the impact pathways of these technologies and gender analysis to inform the adoption decisions for these technologies have not been adequately assessed. Food insecurity and low incomes, therefore, remains a challenge. Furthermore, research evidence gathered from farmers and other relevant stakeholders engaged in the crop and livestock value chains on market access and technology adoption through household surveys are yet to be shared with actors at the local level. As such, information and knowledge gaps exist among researchers, project communities and other key stakeholders. Through community engagements and other policy platforms, this sub-activity will facilitate the sharing of research findings for wider adoption, scaling, and practice for improved wellbeing. | |
|  | |
| 12. Budget Line | STEPRI |
| Personnel | 6,000 |
| Services | 8,000 |
| Supplies | 3,000 |
| Capital | 2,000 |
| Travel | 4,000 |
| Overhead | 3,450 |
| **Total** | **26,450** |

13. Gantt Chart

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|  | **2020** | | | | | | | | | | | | **2021** | | | | | | | | |
| **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** |
| Data extractions (socioeconomic, biophysical, gender) from varied sources |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data organization and analysis |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Community/ district level engagements. |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Policy dialogues |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M&E verification/ Data uploads |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Working on publications/ Journal articles |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Report writing |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned Work** | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: GH4112-20** | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | | | | | | | | | |
| a. Output 4.1 | | | | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | | | | | | | |
| b. Activity 4.1.1 | | | | | Conduct cost-benefit and gender analyses coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts. | | | | | | | |
| c. Sub-activity GH4112-20 | | | | | Evaluate the impact of sustainable intensification practices on household welfare, poverty, perceived shock, the environment, and food and nutrition security in northern Ghana. | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | | Institution | | | | | Role | | | | |
| Shaibu Mellon Bedi | | | Center for Development Research, ZEF | | | | | Team leader, economic analysis and writing | | | | |
| Lukas Kornher | | | ZEF | | | | | Research design and supervision | | | | |
| Bekele Hundie Kotu | | | IITA | | | | | Research design and supervision | | | | |
| Joachim von Braun | | | ZEF | | | | | Research design and supervision | | | | |
| Benedict Boyubie | | | IITA | | | | | Collection of FtF indicators and ensuring data upload on Dataverse | | | | |
|  | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | |
| Name | | | | Institute | | | | | Degree | Start | | End |
| Shaibu Mellon | | | | Center for Development Research, ZEF | | | | | PhD | 2018 | | 2022 |
|  | | | | | | | | | | | | |
| f. Location(s) | Northern Region, Upper West Region, Upper East Region | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | August 2019 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | Sept 2022 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| Much of the impact studies on technology adoption focus on yield and gross income. However, relying on gross income alone for policy decision making geared towards scaling out agricultural innovation may lead to spurious and inaccurate decisions since farmers can easily increase income by reallocating resources from other economic activities given the type of technologies they adopt. Also, differences in variable costs and outputs associated with crop production suggest that gross income and yield alone cannot be relied upon for policy decision making. Therefore, to ascertain the benefits of a technology on household income would require estimating farmers’ return on investment in addition to gross income. Second, most adoption studies fail to capture effects of technology adoption on the frequency or amount of pesticides usage, which can harm the environment .  Indiscriminate use of pesticides can negatively affect the environment. Hence, understanding the impact of adopting new technologies on the environment can play a significant role in scaling out decision making but also on overall human welfare. Third, adoption studies that examined the impact of new technologies on food and nutrition security seldom use both subjective and objective measures of food and nutrition approaches. However, given the complexity and multidimensionality of food security, relying on one approach may only give a narrow view of food and nutrition security at the household level, and not of those of intra-household or individual level. Hence, to understand the impact of adopting new technologies on household food security would require combining the two approaches. Finally, the common mode of disseminating new technologies in Sub-Saharan Africa is through farmer field schools[[41]](#footnote-41)(. The use of incentives with a condition, to spur adoption of new technologies has hardly been studied in developing countries. However, farmer field school [[42]](#footnote-42) have been used to spur the adoption of agricultural practices across most developing countries. The Africa RISING project in Ghana provides a special case study to examine incentive with conditions that can be used to stimulate farmers’ adoption of new technologies. Results can play a significant role in policy decisions related to input subsidies within the sub-region. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 To analyze the factors that influence farmers’ decision to adopt SI practices. | | | | | | | | | | | | |
| 2.2 To examine effects of adopting SI practices on 1) Crop yields; 2) Household welfare; 3) Return on investment; 4) The environment; 5) Food and nutrition security; a6) Poverty rates and 7) Perceived shocks. | | | | | | | | | | | | |
| 2.3 To estimate the effectiveness of using nudges (e.g., free inputs, training) to induce adoption of SI practices. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 Does the adoption of SI practices improve household welfare, return on investments, and the environment? | | | | | | | | | | | | |
| 3.2 Does the adoption of SI practices improve food and nutrition security of farm households? | | | | | | | | | | | | |
| 3.3 Does the adoption of SI practices reduce household poverty? | | | | | | | | | | | | |
| 3.4 Do covariate (e.g. floods) and idiosyncratic (e.g., death of a household member) shocks perceived by farmers in the past influence the adoption of SI practices? | | | | | | | | | | | | |
| 3.4 Are nudges (e.g., free inputs and training) more effective in spurring adoption of SI practices than other conventional approaches (e.g. learning from friends and relatives)? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | |
| The study is based on data from two round surveys in Africa RISING project intervention and control communities in the three regions (Northern region, Upper West Region and Upper East Region). The first survey was conducted in 2014 by the International Food Policy Research Institute (IFPRI) to establish baseline data for the project. That survey considered 1248 randomly selected farm households within the 50 villages (see Tinonin et al., 2016 for details of survey procedures). The second survey was conducted in 2019 as a follow-up of the baseline survey. We employed a three-step approach in sampling the households given the limited budget for the study. First, we fixed a sample size of 700 households and conducted statistical power analysis to check whether our sample size will meet the minimum criterial for an impact analysis[[43]](#footnote-43). Second, we proportionally adjusted sample size of the regions and other administrative divisions to match the baseline sampling information. Finally, we employed a simple random sampling method to sample farmers from a list of farmers sampled in each village during the baseline study. We sampled and interviewed 272 farm households from the control villages, and 428 from the treated villages. The sample from the treated villages were composed of continued and phase-out villages. In each of these sampled villages include both direct beneficiary and non-beneficiary farmers. But prior to the survey, enumerators were hired and trained across each of the regions for about six days. The questionnaire[[44]](#footnote-44) (same as the one used in the baseline) was also amended to accommodate other new questions. The questionnaire was later pretested on the last day of the training in a village different from our final selected villages. Outcomes from the pretesting helped to correct wording of the local language and how questions should be posed to elicit the appropriate responses. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | Responsibility/Institute | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | |  | |
| 5.1 Household data, (demographic, production, food and nutrition security, environment, etc.) | | | | | | | | | | | IITA/ZEF | |
|  | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | Delivery date | |
| 6.3 Journal paper on household welfare | | | | | | Confirmation of manuscript submission by the journal Manuscript[[45]](#footnote-45) | | | | | Feb2021 | |
| 6.4 Journal paper on food security and Scaling-up | | | | | | Confirmation of manuscript submission by the journal | | | | | Mar. 2021 | |
|  | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | |
| Domain | | Indicator | | | | | Metrics/Scale | | | | | |
| 7.1 Productivity | | Crop productivity | | | | | Yield (kg/ha/season) at the field/ plot level | | | | | |
| 7.2 Economic | | Profitability, poverty/welfare | | | | | Net income ($/ha, costs ($/ha), Net income/cost, household level | | | | | |
| 7.3. Human | | Nutrition, food security | | | | | rHHD, WDS, FV\* | | | | | |
| 7.4. Environment | | Pesticide use | | | | | Active ingredient applied/ha | | | | | |
| \*HHD and WDD denote household dietary diversity and women dietary diversity, while FV represents food variety count. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | |
| This study is expected to contribute to policy design aimed at scaling out SI technologies across the three northern regions, especially SI targeted towards reducing poverty and improving food and nutrition security. Results are expected to aid development practitioners, researchers, and extension agents in selecting best-bet technologies for scaling out. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | |
| We expected this work to complement the agronomic protocol of the program | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | |
| * 2 published papers in peer-reviewed journals and conference presentations, Policy briefs | | | | | | | | | | | | |
| * 2 conference presentations | | | | | | | | | | | | |
| * 2 Policy briefs | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  A myriad of technologies has been developed and disseminated across Sub-Saharan Africa. However, the rates of adoption among farmers within the sub-region continue being low. One of the key reasons associated with the low adoption rate is the failure to assess long-term impacts of these technologies on, for example, return on farmers’ investment, farmers perceived shock, and food and nutrition security, environment, etc. Cross-sectional data are often used to examine the benefits of these technologies. However, results from cross-sectional data tend to suffer from endogeneity issues. This can contribute to a | | | | | | | | | | | | |
| wrong policy decision. Also, dynamic changes over the years cannot be captured using cross-sectional data. Therefore, we intend addressing these issues by using three panel datasets taken at different time periods to evaluate long term impacts of adopting SI practices on farmers’ household welfare, including food and nutrition security. | | | | | | | | | | | | |

|  |  |  |
| --- | --- | --- |
|  | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Outputs from this research will be targeted towards researchers, policymakers, and extension officers. | | |
|  | | |
| 12. Budget (US$) | | |
| **Budget line item** | **ZEF** | **IITA** |
| Personnel |  | 25001 |
| Services |  |  |
| Supplies |  |  |
| Capital |  |  |
| Travel |  |  |
| Overhead |  |  |
| **Grand total** | **2500** | |

1IITA scientist’s time cost to supervise the study

13. Gantt Chart

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Tasks | 2020 | | | | 2021 | | |
| 1st | 2nd | 3rd | 4th | 1st | 2nd | 3rd |
| Activity plan |  |  |  |  |  |  |  |
| Training of research assist. |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |  |  |
| Write paper1 and submit |  |  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |  |  |
| Write paper2 and submit |  |  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |  |  |
| Write more papers |  |  |  |  |  |  |  |
| Finalize thesis |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4113-20** | | | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | | | | | | | | | | | | | | |
| a. Output 4.1 | | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | | | | | | | | | | | | | | |
| b. Activity 4.1.1 | | | Map and assess relevant stakeholders to establish a dialogue for the exploration of mutual synergies for scaling delivery of validated technologies | | | | | | | | | | | | | | |
| c. Sub-activity GH4113-20 | | | Provide safety nets to smallholder farmers through crop insurance while developing a business model with multi-stakeholder partners for scaling validated technologies for equity and empowerment | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | | |
| Name | | | | | | Institution | | | | Role | | | | | | | |
| Fred Kizito | | | | | | IITA | | | | -Land and soil management support  - Link the Excellence in Agronomy initiative to Africa RISING efforts on crop calendar advisories in partnership with SEEDPAG and WorldCover. | | | | | | | |
| Abdul Rahman Nurudeen | | | | | | IITA | | | | Cereal agronomy and plant nutrition | | | | | | | |
| Bekele Kotu | | | | | | IITA | | | | Economic analysis | | | | | | | |
| Zakaria Sumani Iddrisu | | | | | | SEEDPAG | | | | Providing improved seed and farmer training | | | | | | | |
| Alhassan Amadu | | | | | | SEEDPAG | | | | Providing improved seed and farmer training | | | | | | | |
| Mohammed Hussein | | | | | | SEEDPAG | | | | Providing improved seed and farmer training | | | | | | | |
| Fuseini Salifu | | | | | | WorldCover | | | | Crop insurance and technology dissemination and farmer support in collaboration with IITA | | | | | | | |
| Benedict Boyoubie | | | | | | IITA | | | |  | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | | Degree | | | | Start | End | |
|  | | | |  | | | | | | |  | | | |  |  | |
|  | | | | | | | | | | | | | | | | | |
| f. Location(s) | Central Gonja, Karga, and Mion districts in Northern Region | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| g. Start | June 2019 | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| h. End | June 2021 | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | | |
| Africa RISING has validated some improved maize and legume varieties which are high in protein and minerals during phase I and farmers in AR communities and beyond have shown interest in these varieties (Abontem, Omankwa and Obatanpa ([[46]](#footnote-46)Africa RISING 2017). However, access to quality seeds of these varieties at farmer and community levels remains a big challenge. Therefore, Africa RISING in partnership with Seed Producers Association of Ghana (SEEDPAG) and WorldCover formed a partnership to scale out the production of quality seeds of the aforementioned varieties at the community level. This activity has a business model approach where the community seed growers produce the seeds for SEEDPAG which then buys back the produce from the farmers for further processing. In addition, selected Africa RISING farmers from some communities have been included in this initiative and farmers interested in the seeds will independently buy seed from SEEDPAG. Africa RISING has provided the initial inputs required to start the activity and the initial seed funds will be recovered during payments from SEEDPAG after farmers’ harvest. SEEDPAG will train farmers on seed production, register and use them as community seed growers to produce certified seeds of the aforementioned validated maize and legume varieties. The aim is to provide entrepreneurial projects for women in strong partnership with the private seed sector to increase and diversify their income sources while using improved seed. It is anticipated that the women farmers will increase the seed volume, seed quantity and quality at the doorstep of other farmers through seed retail at the community level. WorldCover will insure farmers against crop failure from disaster such as drought and they will include validated Africa RISING crop management practices in the insurance policy provided to make farmers less risk averse while helping to disseminate Africa RISING technologies beyond the Africa RISING intervention communities.  We intend to institute a mechanism using the Beneficiary Technology Tracking Tool (BTTT) that will allow us to record and track progress on different farmers that get in touch with the beneficiary groups and the nature of information shared. On-going discussions with the M&E Officer will ensure that this initiative takes effect. | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | | |
| 2.1 Determine the sustainability of the proposed scaling and business model for validated technologies | | | | | | | | | | | | | | | | | |
| 2.2 Build capacity of farmers on validated technologies | | | | | | | | | | | | | | | | | |
| 2.3. Explore the role of insurance in promoting uptake of agronomic interventions through linking with work being conducted in the EiA initiative | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | | |
| 3.1 How does the infusion of business model into technology scaling affect sustainability, increase resilience and offer livelihood options. | | | | | | | | | | | | | | | | | |
| 3.2 How does building capacity of smallholder farmers promote uptake of validated technologies? | | | | | | | | | | | | | | | | | |
| 3.3 What is the role of insurance in promoting uptake of agronomic interventions? | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | | |
| A total of 118 acres of isolated land will be planted with foundation seeds of Omankwa maize across the Central Gonja, Karga and Mion districts in Northern Region. The maize seeds will be planted at a spacing of 75 cm x 40 cm with two seeds per stand. NPK compound fertilizer will be applied to the maize plants at rate of 40 kg/ha at 2 weeks after planting. Sulphate of ammonia fertilizer will be used to top dress the maize plants at rate of 20 kg/ha N at 5 weeks after planting. | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | Responsibility | | | | |
| 5.1 Grain yield of improved maize seeds | | | | | | | | | | | | | IITA | | | | |
| 5.2 Profitability of the business model | | | | | | | | | | | | | IITA | | | | |
| 5.3. Precision of predictions for seasonal calendar | | | | | | | | | | | | | WorldCover | | | | |
|  | | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | Means of verification | | | | | | | End date | | |
| 6.1 Agronomic data | | | | | | | | Dataverse | | | | | | | Mar. 2021 | | |
| 6.2 Cost-benefit data | | | | | | | | Dataverse | | | | | | | Mar. 2021 | | |
| 6.3 Database on business model | | | | | | | | Dataverse | | | | | | | Mar. 2021 | | |
| 6.4 Training reports in collaboration with SEEDPAG | | | | | | | | Training Reports | | | | | | | Dec. 2020 | | |
| 6.5 improved cropping advisories future use by farmers and SEEDPAG | | | | | | | | Link to improved advisories shared in semi-annual project report | | | | | | | May 2021 | | |
|  | | | | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | | | | |
| **Domain** | | **Indicator** | | | | | **Metrics/Scale** | | **Methods/Approaches taken including duration** | | | | | **Before intervention** | | | **After intervention** |
| 7.1 Productivity | | Crop productivity | | | | | Crop productivity (kg/ha) at plot/ field and farm level | | Field yield measurement | | | | | Yield from farmer practice | | | 20% increase in grain yield |
| 7.2 Environmental | |  | | | | |  | |  | | | | |  | | |  |
| 7.3 Economic | | Profitability | | | | | Profitability of the business model (GHS/ha) at the plot/ field level | | Survey and yield measurement | | | | | Net income from farmer practice | | | 15% increase in net income |
| 7.4 Social | |  | | | | |  | |  | | | | |  | | |  |
| 7.5 Human | |  | | | | |  | |  | | | | |  | | |  |
|  | | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | | |
| Scaling of the business model will be achieved through strategic partnership with development partners specifically WorldCover and SEEDPAG. | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | |
| This activity is linked with crop-livestock research activities GH1112-20 and the natural resources management work being done in collaboration with KNUST- Sub-activity GH1212-20 | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | | |
| * Database on business model * Seed Production Training Reports | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Food insecurity and natural resource management challenges.  This sub-activity will address the following major development. (i) food insecurity, (ii) increased productivity can also contribute to a profitable crop enterprise thereby improving household income. | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers, extension agents, and policymakers | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | |
| Budget Line | | | | | SEEDPAG | | | | | | | IITA | | | | | |
| Personnel | | | | | 1,000 | | | | | | | 0 | | | | | |
| Services | | | | | 4,000 | | | | | | | 4,000 | | | | | |
| Supplies | | | | | 0 | | | | | | | 15,000 | | | | | |
| Capital | | | | | 0 | | | | | | | 0 | | | | | |
| Travel | | | | | 2,000 | | | | | | | 2,000 | | | | | |
| Overhead | | | | | 0 | | | | | | | 0 | | | | | |
| **Total** | | | | | **7,000** | | | | | | | **21,000** | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/Month** | **2020** | | | | | | | **2021** | | | | | |
| **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** |
| Farmer sensitization |  |  |  |  |  |  |  |  |  |  |  |  |
| Training of farmers |  |  |  |  |  |  |  |  |  |  |  |  |
| Field establishment |  |  |  |  |  |  |  |  |  |  |  |  |
| Field monitoring |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |  |  |  |
| Community field days |  |  |  |  |  |  |  |  |  |  |  |  |
| Harvesting |  |  |  |  |  |  |  |  |  |  |  |  |
| Data processing and analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Semi-annual report |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4114-20** | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | | | | | | | | | | | | |
| a. Output 4.1 | | | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | | | | | | | | | | | |
| b. Activity: 4.1.1 | | | | Conduct cost-benefit and gender analyses coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts. | | | | | | | | | | | |
| c. Sub-activity GH4114-20 | | | | Evaluate farmers’ preferences for technology attributes and their associated benefits in cereal-legume systems of northern Ghana. | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | | Institution | | | Role | | | | | | | | |
| Bekele Kotu | | | | IITA | | | Team leader, research design, economic analysis and writing | | | | | | | | |
| Abdul Rahman Nurudeen | | | | IITA | | | Agronomist, identification and attributes of maize agronomy | | | | | | | | |
| Oyinbo Oyakhilomen | | | | University of Leuven | | | Research design | | | | | | | | |
| Gundula Fischer | | | | IITA | | | Gender analysis | | | | | | | | |
| Abebe Menkir | | | | IITA | | | Maize breeder, identification and assessment of maize attributes | | | | | | | | |
| Fred Kizito | | | | IITA | | | NRM scientist, identification and assessment of environmental attributes of technology | | | | | | | | |
| Benedict Boyubie | | | | IITA | | | Compilation of FtF indicators and ensuring data upload on Dataverse | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | Institute | | | Degree | | | | Start | | | | | End |
| NIL | | |  | | |  | | | |  | | | | |  |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | Northern Region, Upper West Region, Upper East Region | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | June 2019 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | December 2020 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| Adoption of agricultural technologies usually takes a long time or does not happen at the required level among smallholder farmers. This is partly because technology development does not properly consider the attributes of the technologies that farmers value most. In fact, limited adoption can happen when the technology development process fails to incorporate the traits valued by farmers (Lunduka et al., 2012[[47]](#footnote-47); Dalton, 2003[[48]](#footnote-48)).  While the traits of technologies associated with both consumption and production may be important to guide decisions among smallholder farmers, most studies focus on either one of them at a time. However, considering either consumption related traits or production-related traits of technologies separately may not give a full picture of farmers’ preferences. In fact, unlike farmers in developed countries, smallholder farmers in developing countries are both producers and consumers of their own produce and hence they may evaluate technologies from both production and consumption angles before they decide to grow crops while there are concerns nowadays that technology adoption is associated with unintended adverse effects on the farming system and livelihoods of smallholder farmers.  A good example is the famous green revolution. While the green revolution could reduce rural poverty through rapid growth in productivity (Hazell, 2009[[49]](#footnote-49)), it was associated with negative environmental consequences such as water pollution, and loss of biodiversity (Alauddin & Quiggin, 2008[[50]](#footnote-50); Shiva, 1991[[51]](#footnote-51)) and was thus unsustainable. This implies that sustainability is an important evaluation criterion in the process of technology development. Sustainable intensification entails the application of agricultural technologies (or technology packages) having multidimensional advantages/positive traits (Pretty et al., 2011[[52]](#footnote-52)). Therefore, assessing technologies with respect to farmers’ preferences considering the multidimensional nature of sustainable agricultural intensification is useful to set research priorities and guide policy interventions pertinent to smallholder farmers. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 Identifying important attributes associated with maize production technologies including improved varieties and agronomic practices) as perceived by farmers. | | | | | | | | | | | | | | | |
| 2.2 Assessing the differences in the technology preferences among farmers with respect to gender and farmer typologies. | | | | | | | | | | | | | | | |
| 2.3 Refining technology targeting relevant to farmers’ preferences and providing feedback to researchers, extension agents and development practitioners the key findings of the study. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 What are the attributes of maize production technologies liked by smallholder farmers in Northern Ghana? | | | | | | | | | | | | | | | |
| 3.2 Are there differences among farmers’ categories (gender and other farmer typologies) regarding preferences to technologies attributes? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| We will collect data through a survey of about 600 randomly selected farm households in the three regions of northern Ghana namely, Northern Region, Upper East Region, and Upper West Region. In addition, we will conduct focus group discussions to collect qualitative data on farmers’ preferences and related issues. Discussions with researchers and other key informants will be made. The data from the focus group discussions and the key informant interviews will be used to design the household survey and prepare the questionnaire. The survey will be organized following a choice experiment design in which respondents are asked to choose from the list of different hypothetical technology profiles presented to them. The choice sets will be fixed based on the discussions we will make with farmers, researchers, and other knowledgeable individuals or groups regarding the farming systems in northern Ghana and the performances of different agricultural technologies. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | Responsibility/Institute | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | |  | | | | |
| 5.1 Survey data of farmers perceptions and socio-economic activities | | | | | | | | | | | IITA | | | | |
| 5.2 Qualitative data; list of identified attributes based on focus group discussions | | | | | | | | | | | IITA | | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | Means of verification | | | | | Delivery date | | |
| 6.1 Information brief on insights and perspectives on preferred attributes shared with researchers and extension workers | | | | | | | | Link to Information brief shared in semi-annual technical report | | | | | Sep. 2020 | | |
| 6.2 Journal paper submitted | | | | | | | | Manuscript | | | | | Dec. 2020 | | |
| 6.3 Household survey data archived | | | | | | | | Survey data submitted to Dataverse repository | | | | | Dec. 2020 | | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | | | |
| **Domain** | | **Indicator** | | | **Metrics/Scale** | | | | **Methods/**  **Approaches** | | | **Before intervention** | | **After intervention** | |
| 7.1 Productivity | | Crop productivity | | | Yield (kg/ha), household level  Variability in production, (perception, qualitative measure), household level | | | | Household survey, Focus group discussion, key informant interviews | | |  | |
| 7.2 Environmental | | Soil fertility | | | Qualitative measure (high/low), field level | | | |  | |  | |
| 7.3 Economic | | Cash requirement, Labor requirement | | | Cash requirement (Ghc/ha), labor requirement (person days/ha), household level | | | |  | |  | |
| 7.4. Human | | Nutrition | | | Qualitative measure (low/high), household level | | | |  | |  | |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| farmers’ decisions for the application of the technology. We hope that the results of the study will help researchers to generate technologies that will have a high chance of adoption. It will also help the government extension department and other development practitioners to prioritize technologies for scaling and do proper targeting which will enhance adoption. To this effect, the implementing team intends to release an information brief and share with various stakeholders.This study focuses on technology attributes associated with production and consumption to guide | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| The study assesses technologies with respect to farmers’ preferences in order to improve the adoption. Therefore, this study is linked to the Activity 4.3.1: Monitor and modify the progress of technology adoption process towards scaling as well as to sub-activity 4.1.2: Evaluate the impact of sustainable intensification practices on household welfare, poverty, perceived shock, the environment, and food and nutrition security in northern Ghana. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | |
| * Published paper in peer-reviewed journals and conference presentations | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |

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| 11. Impact-based summary matrix | |
| 11.1 What is the development challenge you are addressing?  Many agricultural technologies have been developed by agricultural research institutions, although several constraints considerably limit their adoption. Lack of compatibility of the technologies to farmers needs is one of the reasons for low adoption rates. Technology scaling is easier when technologies are compatible with farmers’ needs and this would happen when farmers’ technology preferences are considered in the process of technology development. One of the limitations in the agricultural research process is the fact that farmers’ preferences are usually overlooked. Moreover, farmers are not homogenous in their preferences while technology development mostly fails to consider such heterogeneities among farmers. Such situations in the research process have resulted in low demands among farmers for new technologies, early dis-adoption, and sub-optimal adoption while making the scaling process quite challenging. This study addresses this challenge in the adoption of agricultural technologies among smallholder farmers. | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Our study targets a large audience including: i) researchers to set research priorities and define the scaling strategies by considering the farmers’ preferences, ii) extension agents for the technologies scaling on the fields, iii) policymakers to guide the policy interventions, and iv) farmers to make available the technologies that meet their needs in terms of consumption and production. | |
|  | |
| 12. Budget (US$) | |
| **Budget line item** | **IITA** |
| Personnel (casuals and consultants) |  |
| Services (publication fees) | 2000 |
| Supplies |  |
| Capital |  |
| Travel | 5000 |
| Overhead |  |
| **Total** | **7000** |

13. Gantt chart

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/Month** | **2020** | | | | | | **2021** | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** |
| Data organization and analysis |  |  |  |  |  |  |  |  |  |
| Drafting paper |  |  |  |  |  |  |  |  |  |
| Revising paper and submission to journal |  |  |  |  |  |  |  |  |  |
| Ending |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4121-20** | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | | | | | | | | | | |
| a. Output 4.1 | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | | | | | | | | | | | |
| b. Activity 4.1.2 | | Identify (possibly map) and assess relevant stakeholders to establish dialogue for the exploration of mutual synergies for scaling delivery of validated technologies. | | | | | | | | | | | |
| c. Sub-activity GH4121-20 | | Utilize ICT and GIS tools as a means to share information (agronomic, climatic and market services) and scale-out Africa RISING technologies in collaboration with strategic partnerships in the Region. | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | |
| Name | | | | Institution | | | Role | | | | | | |
| Wilson Agyei Agyare | | | | KNUST | | | PI: Soil and water management | | | | | | |
| Fred Kizito | | | | IITA | | | Co-PI: Land and water management | | | | | | |
| B. O. Antwi | | | | Soils Research Institute | | | Soil and water management | | | | | | |
| Abdul Rahman Nurudueen | | | | IITA | | | Cereal Agronomy and plant nutrition | | | | | | |
| Gundula Fischer | | | | IITA | | | Gender and social aspects | | | | | | |
| Benedict Boyubie | | | | IITA | | | FtF indicators and ensure data are uploaded on Dataverse | | | | | | |
|  | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | |
| Beyond soil and water conservation, field observations in recent years have increasingly shown that farmers’ planning of timing of planting and agronomic management practices (e.g. timing of sowing, thinning, fertilizer application, harvesting and storage) is helpful but needs further refinement and guidance. Proper planning offers numerous dividends such as early crop vigor, drought avoidance, tolerance to pests and diseases. The cropping calendar data from last year revealed interesting dynamics that will be shared with Africa RISING farmers as a resilience enhancing approach. For example, based on the participatory survey data compared with specific planting dates ascertained from satellite data reveals differences between scientific estimations and farmers local knowledge. These will be synthesized into informative charts that assist farmers with more precise decision making. This will be conducted through an integrated way by reaching out and communicating with our target audiences through an ICT platform that combines agronomy, markets, climate services and postharvest information for the benefit of farmer empowerment. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | |
| 2.1 Harness the power of ICT to share cropping-calendar messages and other agronomic, weather and market information for farmers’ information empowerment | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 3. Research Questions | | | | | | | | | | | | | |
| 3.3 How can we use the power of ICT to co-develop and share with end-users a crop planning calendar for empowering farmer decision making? | | | | | | | | | | | | | |
| 3.4 What would be the best strategy to map, engage and collaborate with strategic partnerships in the Region as a means to scale out promising SWC measures? | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | |
| Building on accomplishments from the previous season, the team has compiled and analyzed seasonal calendar information for use by farmers and development partners. The team intends to conduct training for efficient use of the seasonal calendar and also provide a refresher training for soil and water conservation measures for the communities in Bonia and Nyangua. The team has partially developed educational brochures and training manuals for educating and training farmers, development partners and extension officers on cropping calendars for improved crop productivity thus developing both human and institutional capacity. The process will be concluded in this research cycle.  Building on activities conducted in sub-activities GH1211-19 and GH1212-19 and GH3211-19in collaboration with ESOKO and WorldCover, we shall use ICT and GIS tools to share and disseminate information on proven agronomic practices as well as on the seasonal calendars (and planting dates information). This activity is an integrating activity across the interventions being promoted within Africa RISING. It will equally entail working closely with other work-packages for packaging the right messages, and timing of message delivery to the end-users. It will also involve awareness-raising on the role and benefits of the platform including both farmers and extension officers. Some of the messages will be tailored around crop agronomy, climate services, market information, and post-harvest management practices. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | Responsibility/Institute | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | |  | | | |
| 5.1 Co-share with end-user’s crop planning decision matrix:   * Historical planting dates for major staples * Date calendars for agronomic practices (e.g. timing of sowing, thinning, fertilizer application, harvesting and storage) | | | | | | | | | | F. Kizito/IITA and W. Agyare/KNUST | | | |
| 5.2 Develop both human and institutional capacity of target farmers towards improved soil and water conservation measures:  We shall assess the knowledge, attitude, skills and aspirations (KASA) of farmers before and after the training and capacity building exercises. The activity will take care of the training and capacity building needs of all the other sub-activities by the team. | | | | | | | | | | F. Kizito/IITA and W. Agyare/KNUST | | | |
|  | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | |
| Deliverables | | | | | Means of verification | | | | | | | Delivery date | |
| Crop planning decision matrix | | | | | Interim Project Report with farmer decision charts for cropping calendars | | | | | | | Feb. 2020 | |
| KASA analysis framework on ICT and GIS with extension workers and farmers on access to mobile phone messages | | | | | Interim Project Report | | | | | | | Mar. 2020 | |
|  | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | **Metrics/Scale** | | | **Methods/**  **Approaches** | | | **Before intervention** | | | | **After intervention** |
| 7.1 Economic | - Profitability  - Input Use Intensity | | - Net income ($/crop/ha/season) at the plot level  - Input per ha at the plot level  - In relation to the market information services received from the ICT platform | | | Computed from productivity data | | |  | | | |  |
| 7.2 Social | - Gender equity  - Collective action | | - Capacity: Access to information (Household)  - Participation in a collective action group (Household) in relation to agronomy, climate services and market information | | | Focus Group Discussions | | |  | | | |  |
|  | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | |
| Strategic partnerships with both public and private sector entities. For the public sector: we shall liaise with MoFA, for the private sector specifically with WorldCover, and local universities. The use of ICT approaches in collaboration with ESOKO and WorldCover as well as participatory video methods and maps will be used as information sharing methods in the target sites with partners and will complement the scaling-up and out through farmer to farmer exchanges on soil and land management interventions that increase on-farm productivity. We link up with on-going initiatives and partnerships such as the Northern Agricultural Sector Working Group (NASWG) and Northern Rural Growth Development Program (NRGDP) as scaling pathways for our research. This will include sharing with them brochures developed for farmer training as well as co-sharing in-field experiences at working group discussions including MoFA as well. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | |
| The activities on cropping calendars and ICT are all-encompassing in the sense that there is information shared on agronomy, climate services and market linkages for the different AR technologies. The training and capacity building will be conducted in liaison with the agronomic work. The proposed work will also link with sub-activity GH3211-19on assessing buffer and adaptive capacity to harness resilience of different farm types. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | |
| * Synthesis: Resilience in cereal-legume farming systems in the context of land and water management strategies * Journal article on land and water management strategies in Cereal-Legume based farming systems * Database on land and water management strategies on Cereal legume-based farming systems | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Food insecurity and poverty (household level) and NRM beyond the plot level: Through this research, the sub-activity will seek information about the vulnerabilities and resilience capacities of the target communities and how this contributes towards reducing food insecurity and poverty and enhance the natural resource base. | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Smallholder farmers, agricultural extension agents, donors (USAID) and policymakers. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | |
| **Budget line item** | | | | | | | | **IITA** | | | **KNUST** | | |
| Personnel\* | | | | | | | | 5,000 | | | 4,000 | | |
| Services\*\* | | | | | | | | 1,000 | | | 500 | | |
| Supplies | | | | | | | | 3,000 | | | 600 | | |
| Capital\*\*\* | | | | | | | | 2,000 | | | 500 | | |
| Travel | | | | | | | | 3,000 | | | 600 | | |
| Overhead | | | | | | | | 0 | | | 760 | | |
| **Total** | | | | | | | | **14,000** | | | **6,960** | | |
| **Grand total** | | | | | | | | **20,960** | | | | | |

Costs of casual workers, drivers, technicians; \*\*Includes costs of engaging ICT consultancy \*\*\*Includes purchase of equipment for soil moisture monitoring.

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | **2021** | | | |
| **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Training |  |  |  |  |  |  |  |  |  |
| Consultancy engagement |  |  |  |  |  |  |  |  |  |
| Designing key messages |  |  |  |  |  |  |  |  |  |
| M&E for verification |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4122-20** | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI, technologies, innovations and practices. | | | | | | | | | | | | | | |
| a. Output 4.1 | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | | | | | | | | | | | | |
| b. Activity 4.1.2 | | Map and assess relevant stakeholders to establish dialogue for the exploration of mutual synergies for scaling delivery of validated technologies. | | | | | | | | | | | | |
| c. Sub-activity GH4122-20 | | Promotion and dissemination of Africa RISING SI interventions for sustained productivity and reduced risk in Ghana using the climate-smart village approach | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | | Institution | | | Role | | | | | | | |
| Samuel Saaka Buah | | | | CSIR-SARI | | | Principal Investigator: Responsible for the overall implementation and coordination of sub-activity, data collection, data analysis and final report | | | | | | | |
| Prince M. Entire | | | | CSIR-SARI | | | Contribution to cost and benefit analysis, monitoring and evaluation as well as the adoption of the climate-smart agriculture practices | | | | | | | |
| Boasiako Ohene Antwi | | | | KNUST | | | Contribution towards the data collection on soil and water management | | | | | | | |
| Abdul Rahman Nurudeen | | | | IITA | | | Contribution towards data collection on agronomy and plant nutrition | | | | | | | |
| Fred Kizito | | | | IITA | | | Provide technical backstopping | | | | | | | |
| Mathieu Ouedraogo | | | | CCAFS/ICRISAT | | | Contribution to the design of monitoring tool for the modification and adoption of the climate-smart agriculture practices | | | | | | | |
| The District Directors | | | | Department of Agriculture (DoA) | | | Assists in the dissemination of Africa RISING SI technologies and information through extension services | | | | | | | |
| Benedict Boyubie | | | | IITA | | | Compilation of FtF indicators and ensures uploading data on Dataverse | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | Institute | | | | | | Degree | | Start | End | | |
| Nil | | |  | | | | | |  | |  |  | | |
|  | | | | | | | | | | | | | | |
| f. Location(s) | Northern (Tingoli, Cheyohi no. 2, Doku, Tibali), Upper East (Samboligo, Nyangua, Gia, Bonia), Upper West (Zanko, Guo, Goli, Goriyiri) regions | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | December 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | May 2022 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| **Statement of the problem**:  Promotion of climate smart agriculture (CSA) practices (of which Africa RISING SI technologies form part) remains a global developmental agenda and one mainstream opportunity to mitigate climate change and sustain the productivity of agricultural systems. Considering this need, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has developed the Climate-Smart Village (CSV) approach as a means to agricultural research for development (AR4D) in the context of climate change. It is an approach where CCAFS in partnership with rural communities and other stakeholders (NARES, NGOs, local authorities), tests and validates in an integrated manner, several agricultural interventions that will be brought to scale.  The CSV approach is founded on the principles of participatory action research for grounding research on appropriate and location/context-specific enabling conditions, generating greater evidence of CSA effectiveness in a real-life setting and facilitating co-development of scaling mechanisms towards landscapes, subnational and national levels. The CSV approach has six components - (1) CSA practices and technologies, (2) climate information services and insurance, (3) local and national public and private institutions, (4) national and subnational plans and policies, (5) farmers’ knowledge and (6) climate and development finance. Each of the components mobilizes specific partners including the research team, agro-meteorology services, local authorities and development partners. Since 2011, CCAFS has been using the CSV approach in West Africa (Ghana, Senegal, Mali, Niger and Burkina Faso) to test and validate several agricultural interventions with the participation of various local partners. In Ghana, substantial successes have been achieved over the last 7 years where through the CSV, climate information was used as an entry point for informing the choice of CSA technologies that have contributed to improved farm productivity and building resilient livelihoods for poor and marginal farmers. Currently, esoko is providing climate information and agro-advisory services for farmers in the CCAFS Climate villages in Lawra and Jirapa Municipals in the Upper West Region. This could be extended to include farmers in other Africa RISING communities. In view of the priorities of Africa RISING, CSIR-SARI will use its experiences with the CSV approach to promote and disseminate Africa RISING SI interventions based on local climate variability for sustained productivity and reduced risk in the intervention communities. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives: The study seeks to promote and disseminate Africa RISING SI interventions based on local climate variability for sustained productivity and reduced risk in the intervention communities. | | | | | | | | | | | | | | |
| 2.1 Assess the extent to which Africa RISING beneficiaries have embraced SI technologies. Constraints associated with the use of SI technologies will be identified and addressed in order to assist in further promotion of these technologies. | | | | | | | | | | | | | | |
| 2.2 Promote the use of climate information as a basis for farm management decisions | | | | | | | | | | | | | | |
| 2.3 Promote the adoption of CSA technologies and practices (of which Africa RISING SI technologies form part) based on local needs for improved adaptive capacity to climate change and variability | | | | | | | | | | | | | | |
| 2.4 Capacitate farmers and extension agents in climate change and climate-smart agriculture through community trainings with pre-developed content leveraged from CCAFS collaborative activities | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What climate, soil, production and socio-economic factors informed choice and use of Africa RISING SI technologies? | | | | | | | | | | | | | | |
| 3.2. How will climate, soil, production and socio-economic factors that informed choice and use of Africa RISING SI technologies be used to further promote the technologies? | | | | | | | | | | | | | | |
| 3.3 How does provision and use of climate information services relate to farm productivity and livelihoods of smallholder farm communities based on choice of Africa RISING SI technologies? | | | | | | | | | | | | | | |
| 3.4 What combinations of SI technologies are attractive to farmers, reduce vulnerabilities and increase the likelihood of adoption? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| 4.1 Baseline assessment, including climate risk analysis and gender and social inclusion analysis;  4.2 Focus group discussion with men and women farmers will be conducted to generate data on social SI indicators and farmers’ views about climate change and variability in general. See Annex I for the detailed protocol.  4.3 Participatory identification and prioritization of Africa RISING SI technologies  based on biophysical, socio-economic, gender, policy and institutional context; also considering possible  synergies and trade-offs amongst individual activities;  4.4 Provision of climate information services to farmers using climate forecast communication and the PICSA approach  4.5 Evaluation of portfolios of Africa RISING SI technologies (e.g. providing value-added weather services to farmers, building capacity in climate change adaptation and facilitating community partnerships for knowledge sharing);  4.6. Evaluation of farmers knowledge and perception of climate-smart interventions (e.g. cowpea living mulch’ time of fertilizer application, drought tolerant maize varieties), and determination of climate, farm and farmer characteristics that influence the choice of SI technologies,  4.7 Capacity building for the scaling up of climate-smart interventions through policies and institutions, and scaling out to large areas through farm-to-farm approach  4.8. Verification demonstrations conducted on two seedbed types (flat vs. tie ridges or Ridges vs. tie ridges) in each community.  4.9. Verification demonstrations conducted on flat vs. tie ridges or earth bunds in each community. The tie ridges and earth bunds are adopted using previous research results in northern Ghana | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | | Responsibility |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | | | | |  |
| 5.1 Crop (Grain and Stover yields kg/ha); Stover is used as livestock feed   * Soil analysis (OC, N, P, K), and soil moisture content * Socio-economic data at field/plot level; Labour involved, cost of other inputs such as seed, pesticide and fertilizers (used for economic analysis) * Quantitative and qualitative socioeconomic data (Information on attitudes and opinions on climate change and adaptation) | | | | | | | | | | | | | | SARI |
| 5.2 A participatory assessment of the verification demonstrations will be conducted with the communities. Data will consist of disaggregated counts of verified demos. | | | | | | | | | | | | | | SARI |
| 5.3 Historic weather information for the project sites and annual weather data throughout the study. Sites will include the Africa RISING communities in the NR, UER and UWR | | | | | | | | | | | | | | SARI |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | End date | | | |
| 6.1 Baseline assessment report that will contain the Africa RISING SI technologies based on climate, soil, crop, crop, livestock and socio-economic factors | | | | | | Semi-annual report | | | | | August 2020 | | | |
| Insights in potential SI adoption impacts of selected validated technologies/practices | | | | | | Technical Reports | | | | | August 2020 | | | |
| 6.2. Training workshop of farmers and extension agents in climate change and Africa RISING SI technologies | | | | | | Training report | | | | | September 2020 | | | |
| 6.3. Climate information delivered to farmers through the climate forecast communication workshop and the PICSA approach | | | | | | Activity report | | | | | August 2020- April 2021 | | | |
| 6.4 Demonstrations on selected Africa RISING SI technologies | | | | | | Progress and final report | | | | | Dec 2020 | | | |
| 6.5 Assessment of Climate-Smart interventions | | | | | | Activity report | | | | | July - December 2020 | | | |
| 6.6 Paper on the use of the Climate-smart village approach to mainstream climate variability in the promotion and dissemination of integrated crop-livestock-soil systems for sustained productivity and reduced risk in Ghana (data from previous year) | | | | | | confirmation from journal of receipt of submission | | | | | May 2021 | | | |
| 6.7. Contribution towards finalization of West Africa Handbook | | | | | | West Africa Handbook | | | | | Dec 2020 | | | |
|  | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | | | **Metrics/Scale** | | | **Methods/**  **Approaches** | | **Before intervention** | | | **After intervention** | |
| 7.1 Productivity | Crop productivity  Crop biomass productivity | | | | Grain yield (kg/ha) at plot/ field level  Stover yield (kg/ha) at plot/ field level | | | Survey and farmer evaluation | | Baseline | | | Farmer evaluation after intervention | |
| 7.2 Environmental | Soil chemical quality | | | | Soil pH,  Total amount of soil Carbon and soil nutrient at plot/ field level | | | Field experiment | | Initial soil analyses | | | Final soil analyses | |
| 7.3 Economic | Profitability,  Labour requirement, | | | | Net income at plot/ field level  Labor requirement (hours/ha) at plot/ field level | | | Survey and farmer evaluation | | Baseline information | | | Farmer evaluation after intervention | |
| 7.4 Social | Gender equity  Technology assessment by gender  Social cohesion | | | | Rating of technologies by gender at household level  Access to information/ education  Collective action groups at the community level | | | Farmer evaluation | |  | | | Farmer assessment after intervention | |
| 7.5 Human | Capacity to experiment  Social cohesion | | | | Number of new practices being tested (Household level)  -% of farmers experimenting (Community level) | | | Lookup tables and survey | | Baseline | | | Survey after intervention | |
|  | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | |
| Scaling will be achieved through strategic partnership such as the Department of Agriculture (DoA), esoko, GMET, GNFS and Non-Governmental Organizations such as the Mennonite Economic Development Associates (MEDA) and by organizing stakeholder meetings with farmers, extension officers and traditional leaders on the results of the trials Knowledge transfer and scaling strategies will include: establishment of research-for-development plots to demonstrate technologies; development of media materials (posters, fact sheets, policy briefs leaflets, films) for extension staff, farmers, etc.; exchange visits for farmers and researchers; training of trainers and hands-on training for farmers, community outrage programs (Local FM stations) and traditional durbars as well as scientific papers will be used to communicate to the wider public. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | |
| The study assesses technologies with respect to farmers’ preferences in order to improve the adoption. Therefore it is linked with cost-benefit and gender analysis coupled with other socio-economic analyses of selected SI technologies/practices to identify and quantify adoption constraints and opportunities for different farmer contexts, and also to have a better understanding of the adoption potential of these proven technologies and opportunities for scaling up. | | | | | | | | | | | | | | |

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| --- | --- | --- | --- |
|  | | | |
| 10. Custom indicators | | | |
| * Number of demonstrations established * Number of farmers trained * Number of field days organized * Number of meetings/workshops attended * Number of project reports produced * Number of technical leaflets and policy briefs produced * Number of journal articles submitted/published | | | |
|  | | | |
| 11. Impact-based summary matrix | | | |
| 11.1 What is the development challenge you are addressing?  Food insecurity, natural resource management, and climate change adaptation.  This sub-activity will address the following major development challenges. (I) food insecurity, (ii) the sub-activity will also reduce the negative effects of climate change and variability on crop productivity, (iii) it will also increase farmers adaptive capacity to climate change and contributes to increasing crop productivity in the area and (iv) increased productivity can also contribute to a profitable crop enterprise thereby improving household income. | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers (smallholder crop and livestock farmers), extension agents, and policymakers. | | | |
|  | | | |
| 12. Budget (US$) | | | |
| **Budget Line** | **CSIR-SARI** | **UDS** | **WorldVeg** |
| Personnel | 3,950 |  |  |
| Services | 3,900 |  |  |
| Supplies | 0 |  |  |
| Capital | 2,780 |  |  |
| Travel | 2,800 |  |  |
| Overhead | 2,014 |  |  |
| **Total** | **15,444** |  |  |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 2020 | | | | | | | | | | | | 2021 | | | |
| **Month** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Apr** | **May** |
| Needs assessment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Farmer engagement |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Training |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Assessment of Africa RISING SI technologies |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M&E for verification |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4311-20** | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices are built. | | | | | | | | | | | | | | |
| a. Output 4.3 | | | | A framework for monitoring and evaluating technology adoption, and technology-associated risk accessible to the project team and scaling partners. | | | | | | | | | | |
| b. Activity 4.3.1 | | | | Monitor and modify the progress of technology adoption process towards scaling. | | | | | | | | | | |
| c. Sub-activity GH4311-20 | | | | Matching agricultural technologies to farms and their context. | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | Institution | | | Role | | | | | | | | |
| Jeroen Groot | | | WUR | | | Farming systems analysis (Activity Leader) | | | | | | | | |
| Francis Muthoni | | | IITA | | | GIS | | | | | | | | |
| Beliyou Haile | | | IFPRI | | | Economic analysis | | | | | | | | |
| Lieven Claessens | | | IITA | | | Farming systems analysis | | | | | | | | |
| Carlo Azzarri | | | IFPRI | | | Economic analysis | | | | | | | | |
| Benedict Boyubie | | | IITA | | | FtF indicators and ensure data upload on Dataverse | | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | Institute | | | | | Degree | Start | | | End | | | |
| Vacancy | | WUR | | | | | MSc | Sep. 2019 | | | Mar. 2020 | | | |
|  | | | | | | | | | | | | | | |
| f. Location(s) | Districts in NR, UER, UWR | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | 1 September 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | 1 September 2020 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| Increasingly, mobile phones and other ICT services are used to provide information and advice to farmers to facilitate learning, but support to targeting and scaling of agricultural technologies through ICT tools is scarce. ICT-based targeting and scaling approaches should not be considered a silver bullet, although they can increase the reach and reduce the costs of technology dissemination compared to traditional village extension services.  Sophisticated models of technology integration in farming activities exist, but they are often very data-intensive and do not extend beyond the farm level. Muthoni *et al*. (2017)[[53]](#footnote-53) utilized spatially gridded biophysical and socio-economic layers to generate what they called “sustainable recommendation domains” (SRDs) that could be targeted for scaling specific technologies. The effectiveness of the suitability assessment can be further refined as long as the features of individual farms are considered and directly related to technology characteristics during the targeting phase. Innovations in coupling knowledge among site characteristics, household features and technology attributes with the SRDs is needed to guide spatial targeting of suitable technologies.  The FarmMATCH approach explicitly tries to fill this knowledge gap, facilitating the matching between agricultural technologies to farms and their context. It contains 1) a learning and matching algorithm that identifies the most suitable and promising technologies for different farm types, and 2) a data mining and signaling algorithm that identifies hotspots of suitability of technologies and potential adopters. The matching algorithm combines contextual, farm and technology characteristics to create a ranking of the suitability and adoption probability of available innovations. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 Test and improve the ‘matching’ algorithm on a large dataset | | | | | | | | | | | | | | |
| 2.2 Determine the ease of scarce data collection at farms | | | | | | | | | | | | | | |
| 2.3 Obtain feedback from farmers on the technology priority lists | | | | | | | | | | | | | | |
| 2.4 Develop a mechanism for feeding collected data to the database and improve algorithm learning | | | | | | | | | | | | | | |
| 2.5 Develop the ‘signaling’ algorithm | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What is the quality of the generated priority lists for large samples of farms in different agroecological and socioeconomic conditions? | | | | | | | | | | | | | | |
| 3.2 Can the necessary set of scarce data be collected swiftly and reliably from farmers upon farm visit? | | | | | | | | | | | | | | |
| 3.3 What is the farmer perception of the generated priority list of technologies suggested for implementation? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| 4.1 Data collection: GIS and GARBES databases for intervention areas in Northern Ghana will be used to select 1 km2 grid cells with surveyed households. A minimal set of supplementary data on farm and household features and on-farm technologies and practices may be collected.  4.2 We select 15-30 grid cells of 1 km2 from the three Northern regions of Ghana (NR, UER, UWR), so 5-10 cells per region. These cells differ in biophysical conditions (soil, rainfall, etc.) and socio-economic circumstances (e.g. distance to market). Moreover, within these cells we have at least 10 households sampled within the GARBES database collected by IFPRI; if this is not the case then additional data collection is required. In total ca. 300 farms will be included. There should also be diversity among the sampled households in the grid cell. For each household, we analyze in particular the main, easy to collect farm and household features (size, objectives, livestock, crop number, % off-farm income, etc.) and relate these to the farm practices and project-proposed technologies and techniques. The matching algorithm combines the GIS-derived data on biophysical conditions and socio-economic context circumstances with the farm features, to estimate the probability of use of the various technologies and techniques. The data set will be divided between a training set (n=200-240) and a testing set (n=60-100). | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | Responsibility/Institute | | | | |
| Is the collected data part of a multi-year experiment/trial? No | | | | | | | | | |  | | | | |
| 5.1 Compiled dataset | | | | | | | | | | WUR | | | | |
| 5.2 Programmed algorithms | | | | | | | | | | WUR | | | | |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | Delivery date | | |
| 6.1 Journal article | | | | | | | PDF of submitted paper | | | | | 1 Sep.2020 | | |
| 6.2 MSc thesis student report | | | | | | | PDF of report | | | | | 1 Sep. 2020 | | |
| 6.3 Datasets and algorithms | | | | | | | Items uploaded in Dataverse | | | | | 1 Sep. 2020 | | |
|  | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | | |
| **Domain** | | | **Indicator** | | **Metrics/Scale** | | | **Methods/**  **Approaches** | | **Before intervention** | | | | **After intervention** |
| 7.1 Human condition | | | Capacity to experiment | | Willingness to implement a new farm configuration after disturbance | | |  | |  | | | |  |
| 7.2 Social | | | Equity | | Rating of farm configurations per group and agency (leadership roles) | | |  | |  | | | |  |
|  | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | |
| The modelling results will be discussed in farmer meetings. Findings will be shared and published. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | |
| The activity is linked to GH1211-19 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | |
| * Journal paper * MSc Thesis | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Increasingly, mobile phones and other ICT services are used to provide information and advice to farmers to facilitate learning, but support to targeting and scaling of agricultural technologies through ICT tools is scarce The FarmMATCH approach explicitly tries to fill this knowledge gap, facilitating the matching between agricultural technologies to farms and their context. | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Smallholder farmers, agricultural extension agents, and policymakers | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 12. Budget (US$)- **This sub-activity is finishing pending deliverables promised for 2019 hence no budget is proposed** | | | | | | | | | | | | | | |
| **Budget line item** | | | | | | | | **WUR** | **IITA** | | | | **IFPRI** | |
| Personnel | | | | | | | |  |  | | | |  | |
| Services | | | | | | | |  |  | | | |  | |
| Supplies | | | | | | | |  |  | | | |  | |
| Capital | | | | | | | |  |  | | | |  | |
| Travel | | | | | | | |  |  | | | |  | |
| Overhead | | | | | | | |  |  | | | |  | |
| **Total** | | | | | | | |  |  | | | |  | |
| **Grand total** | | | | | | | | **0** | | | | | | |

\*\*\* There was no budget assigned for 2020/2021 since the sub-activity was carried over from 2019/2020 and is in the process of finalizing the deliverables.

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/Month** | **2019** | | | | | | | | | | | | **2020** | | | | | | | | | | | | |
| **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| Starting |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Make GIS maps with grid cells |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Compile ARBES data in relational DB |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Test machine learning algorithms on data |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Drafting paper for scientific journal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Revising paper and submission to journal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ending |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned Work** | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4312-20** | | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI, technologies, innovations and practices. | | | | | | | | | | | | | | | | |
| a. Output 4.3 | | | A framework for monitoring and evaluating technology adoption, and technology-associated risk accessible to the project team and scaling partners. | | | | | | | | | | | | | |
| b. Activity 4.3.1 | | | Monitor and modify the progress of technology adoption process towards scaling. | | | | | | | | | | | | | |
| c. Sub-activity GH4312-20 | | | Investigate the distribution of benefits from diverse agricultural interventions | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | Role | | | | | | | | | |
| Eva Thuijsman | | | | | WUR | | data collection, analysis, reporting | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | Degree | | Start | | End | | | | |
|  | | | |  | | | |  | |  | |  | | | | |
|  | | | | | | | | | | | | | | | | |
| f. Location(s) | | Duko (Northern Region) and Nyangua (Upper East Region) | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | | March 2019 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End | | December 2021 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| Since 2013 Africa RISING has been testing and disseminating diverse technologies aimed at improving livelihoods and resilience in poor rural communities in Northern Ghana. While Phase I was focused on testing technologies, Phase II is making technologies ready for scaling. The last year of Phase II is an excellent time to look back at these years of experience and see what the adoption and adaptation of technologies have meant for the intended beneficiaries.  Among those beneficiaries, the poor – vulnerable through their powerlessness and limited resources – are arguably difficult to reach. Recent research within Africa RISING revealed that low resource-endowed households had much smaller absolute benefits from technologies than high resource-endowed households (Michalscheck et al. 2018). Numerous studies on the impact of agricultural technologies have concluded that benefits are unequally distributed and that the poorest tend to be too limited in their means to successfully employ technologies in farming (among many others: Greeley et al., 1980; Franke et al., 2014; Ritzema et al., 2017). This poses a clear challenge: to develop approaches for equitable technology scaling.  To develop such an approach, it is important to first describe and explain the distribution of benefits from diverse technological interventions, and then explore and design alternative intervention pathways with equitable and resilient livelihood outcomes, in iterative learning loops with intended beneficiaries.  This sub-activity is focused on the first steps in these iterative loops: describing and explaining the drivers of (un)equal livelihood outcomes of agricultural interventions and assess the contribution of agricultural interventions to smallholder resilience.  This sub-activity is part of a PhD trajectory – a multi-year action research project that is intended to continue after Africa RISING phases out – to assess how intended beneficiaries engage with technologies when the project is no longer directly involved. Throughout the research, a methodology will be developed and tested for the participatory assessment of the drivers of the (in)equality of agricultural intervention outcomes, together with the intended beneficiaries. The methodology should serve to learn what might be (unintended) consequences of the implementation of interventions in a differentiated population. Thereby it can guide the scaling approaches of Africa RISING technologies, towards improved equity and resilience.  **References**  **Franke**, A. C., van den Brand, G. J., & Giller, K. E. (2014). Which farmers benefit most from sustainable intensification? An ex-ante impact assessment of expanding grain legume production in Malawi. *European Journal of Agronomy*, *58*, 28–38. https://doi.org/10.1016/j.eja.2014.04.002  **Greeley**, M. (1980). Rural technology, rural institutions and the rural poorest. *Discussion Paper*. Institute of Development Studies, University of Sussex.  **Michalscheck**, M., Groot, J. C. J., Kotu, B., Hoeschle-Zeledon, I., Kuivanen, K., Descheemaeker, K., & Tittonell, P. (2018). Model results versus farmer realities. Operationalizing diversity within and among smallholder farm systems for a nuanced impact assessment of technology packages. *Agricultural Systems*, *162*(January), 164–178. https://doi.org/10.1016/j.agsy.2018.01.028  **Ritzema**, R. S., Frelat, R., Douxchamps, S., Silvestri, S., Rufino, M. C., Herrero, M., … van Wijk, M. T. (2017). Is production intensification likely to make farm households food-adequate? A simple food availability analysis across smallholder farming systems from East and West Africa. *Food Security*, *9*(1), 115–131. https://doi.org/10.1007/s12571-016-0638-y | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| 2.1 Understand the drivers of (un)equal livelihood outcomes of agricultural interventions | | | | | | | | | | | | | | | | |
| 2.2 Assess the contribution of agricultural interventions to resilience. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 How do agricultural technologies influence (in)equality and resilience? | | | | | | | | | | | | | | | | |
| 3.2 What are contextual drivers (e.g. resource access, interdependencies, risks) of (un)equal technology outcomes? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| To assess the intervention history in Duko and Nyangua I will make use of the existing Africa RISING datasets and reach out to contact persons of Africa RISING’s past and present work plans.  I will first interview a random sample of Africa RISING beneficiaries and I will use the snowball method for sampling further study participants (Goodman, 1961). In this method, respondents are asked to identify one or a few other potential participants, in this case on the basis of for instance collaborations, competition or (displaced) service provision. These participants can include direct project beneficiaries and others. The unit of analysis is the individual rather than the household, to allow for capturing intra-household inequities.  Topics during semi-structured interviews include the goal for which participants implement an Africa RISING technology, the availability of alternatives to reach the same target, and how these technologies may affect access to resources (type, quantity, quality, timing) for different people. In interactive exercises I will draw with the participant calendars of supply and demand of resources (with quantification), and networks of collaboration, using colored tokens as symbols to facilitate the discussion. Relations will be discussed in detail, to derive whether the poorer and better-off fulfil particular roles regarding the implementation of an intervention and in agricultural development project participation. I will derive from this the characteristics of the marginalized in the study village, so that I can identify them and include them in the research. I will also specifically interview owners, middlemen, managers and users of shared resources and infrastructure to assess conditions for access and use. For the same purpose I will be an observant during some group meetings (e.g. for organizing labour or cash saving).  After discussing with study participants the types, frequency and severity of locally relevant shocks, a causal loop diagram will be drawn interactively to assess in what way Africa RISING technologies may contribute to one or more of the absorptive, adaptive and transformative resilience capacities (Béné et al., 2012). Serfilippi and Ramnath (2018) recently reviewed resilience measurement strategies and their work will be used as a guide to select indicators for assessing how agricultural interventions contribute to resilience. This involves a comparison to an alternative technology or to the situation before introduction of the intervention. Examples of such indicators are individual preparedness strategies, access to safety nets, productive assets, days with sufficient food per year.  I intend to visit the study villages three times across three years, visiting the same participants and adding new ones as the study progresses. Per village I expect to interview approximately 40 persons in-depth (semi-structured interviews, drawing calendars and networks) during repeated visits and approximately 15 key informants (shorter interviews to obtain specific information, e.g. market prices).  The methods and planning may be adapted or delayed depending on how the Covid-19 crisis unfolds. Safety of all those involved is of primary importance.  **References**  **Béné,** C., Wood, R. G., Newsham, A., & Davies, M. (2012). *Resilience: New Utopia or New Tyranny? Reflection about the Potentials and Limits of the Concept of Resilience in Relation to Vulnerability Reduction Programmes*. *IDS Working Papers* (Vol. 2012). https://doi.org/10.1111/j.2040-0209.2012.00405.x  **Goodman**, L. A. (1961). Snowball Sampling, *32*(1), 148–170.  **Serfilippi**, E., & Ramnath, G. (2018). Resilience Measurement and Conceptual Frameworks: a Review of the Literature. *Annals of Public and Cooperative Economics*, *89*(4), 645–664. https://doi.org/10.1111/apce.12202 | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | Responsibility / Institution | | | |
| 5.1 Anonymized interview data about direct and indirect technology impacts, and resource use and availability. | | | | | | | | | | | | | Eva/WUR | | | |
|  | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | End date | | | | | | |
| 6.1 Report on drivers of differentiated technology impacts. | | | | | | PDF of report | | | | December 2021 | | | | | | |
|  | | | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | | | **Metrics/Scale** | | | | **Methods/**  **Approaches** | | **Before intervention** | | | **After intervention** | | |
| 7.1 Productivity | Variability of production;  Post-harvest losses | | | | Rating of production risk,  % harvest lost, farmer level | | | | Interviews | |  | | |  | | |
| 7.2 Environmental | Resource availability | | | | Natural resource distributions, irrigated land, map, community level | | | | Interviews, transect walks | |  | | |  | | |
| 7.3 Economic | Variability of profitability;  Income Diversification;  Market orientation | | | | Welfare categorization, assessment of livelihood strategies, calendars of resource supply and demand, farmer and community level. | | | | Interviews, interactive exercises | |  | | |  | | |
| 7.4 Social | Equity | | | | Access to resources  Capacity (access to information)  Achievements (resilience)  Variability and distributions: farmer and community level. | | | | Interviews, network analysis | |  | | |  | | |
| 7.5 Human | Food security | | | | Food availability, accessibility, at farmer and community level. | | | | Interviews | |  | | |  | | |
|  | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| Throughout the research, a methodology will be developed and tested for the participatory assessment of the drivers of the (in)equality of agricultural intervention outcomes, together with the intended beneficiaries. The methodology should serve to learn what might be (unintended) consequences of the implementation of interventions in a differentiated population. Thereby it can guide the scaling approaches of Africa RISING technologies (by Africa RISING and those building on their legacy in the future), towards improved equity and resilience. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | |
| The activity builds on prior research within Africa RISING on technology impacts, evaluations and welfare distributions in the study villages. The activity consolidates insights from the diverse technologies and the years of experience that Africa RISING and the beneficiaries have since the onset of project activities in Duko and Nyangua in 2013.  To assess the intervention history in Duko and Nyangua I will make use of the existing Africa RISING datasets and reach out to contact persons of Africa RISING’s past and present work plans. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | |
| One project report | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Unequal distributions of benefits of agricultural interventions, the risk of the poor losing out in progress toward resilience | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Intended beneficiaries and extension agents. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | | |
| **Budget Line** | | | | | | | | | | | | | | | | **WUR** |
| Personnel | | | | | | | | | | | | | | | | 0 |
| Services | | | | | | | | | | | | | | | | 4,025 |
| Supplies | | | | | | | | | | | | | | | | 11,500 |
| Capital | | | | | | | | | | | | | | | | 0 |
| Travel | | | | | | | | | | | | | | | | 3,000 |
| Overhead | | | | | | | | | | | | | | | | 0 |
| **Total** | | | | | | | | | | | | | | | | **18,525** |

|  |
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13. Gantt Chart

The planning may be adapted or delayed depending on how the Covid-19 crisis unfolds. Travel to and from Ghana by the researcher may not always be possible or responsible. Safety of all those involved is of primary importance.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | 2021 | | | | | | | | | | | |
| **Month** | J | F | M | A | M | J | J | A | S | O | N | D |
| Participatory exercises  in Africa RISING villages |  |  |  |  |  |  |  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Reporting |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 4: GH4313-20** | | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI, technologies, innovations and practices. | | | | | | | | | | | | | | | | |
| a. Output 4.3 | | | An updated framework for monitoring technology adoption to be used by the project team and scaling partners available and accessible | | | | | | | | | | | | | |
| b. Activity 4.3.1 | | | Monitor and report technologies and their associated beneficiaries or farmers exposed to the innovations using the tools developed by IFPRI. | | | | | | | | | | | | | |
| c. Sub-activity GH4313-20 | | | Addressing constraints limiting adoption of SI technologies as a result of competing interests for natural and other household resources | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | | | | Role | | | | | | |
| Alhassan Lansah Abdulai | | | | | CSIR-SARI | | | | | Lead Investigator: Coordination of sub-activity, data collection, data analysis, development of management strategies for competing interests, and final report writing | | | | | | |
| Iddrisu Yahaya | | | | | CSIR-SARI | | | | | Coordination of the development of survey instrument, training of enumerators, data collection and analysis, and report on competing interests | | | | | | |
| Fred Kizito | | | | | IITA | | | | | Contributing to the development of survey instrument, data analysis and development of management strategies for competing interests | | | | | | |
| Benedict Ebito Boyubie | | | | | IITA | | | | | Developing data collection tools, training of the research team on Feed the Future indicators and supporting data collection to track output level and Feed the future indicators,  Ensuring data upload on Dataverse | | | | | | |
|  | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | | | | Degree | | Start | End | | |
| Nil | | | |  | | | | | | |  | |  |  | | |
|  | | | | | | | | | | | | | | | | |
| f. Location(s) | Northern Region (Tingoli, Cheyoli No2 and Doku ); Upper West Region (Guo, Goli and Goriyiri); Upper East Region (Nyanguo, Gia and Bonia) | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| g. Start | July 2019 | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| h. End | Apr 2021 | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | |
| Northern Ghana has a very fragile climate which requires use of sustainable intensification interventions to ensure that smallholder farmers are able to benefit from the natural resource base. In turn, this will require adoption of sustainable intensification technologies that will bolster productivity, increase income and improve household nutrition for women and children while not deteriorating the natural resource base. Adoption of SI technologies will enhance resilience and adaptive capacity through reduced risks and/or increased productivity of smallholder systems. However, promoters and disseminators of SI technologies (researchers and extension agents) need to understand and properly manage issues of competing interests for natural and other household resources required for SI technologies uptake in order to increase the chances of adoption. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | |
| 2.1 Increase understanding of promoters and disseminators of SI technologies on competing interests for natural and household resources required for SI technologies promoted by Africa Rising | | | | | | | | | | | | | | | | |
| 2.2 Identify and document competing interests for natural and other household resources required for SI technologies promoted by Africa Rising | | | | | | | | | | | | | | | | |
| 2.3 Propose strategies for managing competing interests for natural and other household resources for increased adoption and continuous use of SI technologies promoted by Africa Rising. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | |
| 3.1 Are there tradeoffs that need to be explored in relation to competing interests for the natural and other household resources required for successful adoption of SI technologies promoted by Africa Rising? | | | | | | | | | | | | | | | | |
| 3.2 Which SI technologies promoted by Africa Rising have low adoption rate as a result of competing interests, for natural and other household resources, from existing production and/or livelihood systems? | | | | | | | | | | | | | | | | |
| 3.3 To what extent will promoters’ and disseminators’ understanding and management of competing interests for resources influence the adoption and continuous use of SI technologies promoted by Africa Rising? | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | |
| * Review of project documentation to Compile and profile of SI technologies disseminated and promoted since the inception of the project * Community entry and sensitization on the sub-activity * Focused group discussions to decipher and document SI technologies disseminated and promoted at each of the communities * Focused group discussions and individual interviews to determine and document cases of conflicting claims for resources between the promoted SI technologies and already existing technologies * Participatory analysis of the nature of conflicting claims to resources to development and pilot mitigation strategies * Participatory planning, implementation and evaluation of mitigation strategies for managing conflicting claims to resources * Develop and publish checklist of competing claims | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | | | | Responsibility |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | | | | | | |  |
| 5.1 Survey Data: Data on competing claims for natural and other household resources | | | | | | | | | | | | | | | | Iddrisu Yahaya (SARI) |
| 5.2 Domains of extrapolation for strategies (Dec. 2020) | | | | | | | | | | | | | | | | Alhassan Lansah Abdulai (SARI) |
|  | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | | Date of Delivery | | | |
| 6.1 Database upload from the survey data | | | | | | | Dataverse | | | | | | December 2020 | | | |
| 6.2 Analysis report on competing interests for natural, human, financial resources of farmers | | | | | | | Project report to be published in CGSpace | | | | | | October 2020 | | | |
| 6.3 Proposed strategies for managing competing interests for natural and other household resources | | | | | | | Proposed strategies to be published on CG Space | | | | | | October 2020 | | | |
| 6.4 Recommendations for managing competing interests for natural and other household resources | | | | | | | Project report to be published in CGSpace Factsheets and leaflets on understanding and managing competing interests developed | | | | | | October 2020 | | | |
| 6.5 Focus Group discussions on insights from conflicts | | | | | | | Field visits,  Semi-Annual Project Report | | | | | | October 2020 | | | |
| 6.6 Domains of extrapolation for strategies | | | | | | |  | | | | | | December 2020 | | | |
| 6.7 Paper publication, Policy briefs and leaflets | | | | | | |  | | | | | | Jun . 2021 | | | |
|  | | | | | | | | | | | | | | | | |
| **7. Sustainable intensification indicators** | | | | | | | | | | | | | | | | |
| **Domain** | | **Indicator** | | | | **Metrics/Scale** | | | **Methods/**  **Approaches** | | | **Before intervention** | | | **After intervention** | |
| 7.4 Social | | Collective action  Social Cohesion | | | | -Incidence of conflicts related to collective action at the household/ community/landscape scale  - Participation in social groups at the community/landscape scale | | | Focus group discussion and individual interviews  Focus group discussion and individual interviews | | | zero  Low | | | Zero  High | |
| 7.5 Human | | Capacity to experiment  Food security | | | | -# of new practices being tested at the community/landscape scale and teasing out if the technologies being promoted enhance innovation and cohesion  Months of food insecurity | | | Focus group discussion and individual interviews  Survey (Individual interviews) | | | Nil | | | All the SI interventions being promoted by Africa RISING project | |
|  | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | |
| The study will be conducted in nine Africa RISING Project communities (three from each of Northern, Upper East, and Upper West regions). Through community focus group discussions farmers are expected to participate and share information amongst themselves but will also share this information beyond their peers in the community and these will serve as vehicles for dissemination. In addition, there will be collaboration with agricultural extension agents from the departments of Agriculture of the Metropolitan Municipal and District Assemblies (MMDAs) who in turn have a wider reach to other farmers beyond the project target communities. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | |
| This activity links to a previous study on work conducted by STEPRI relating to constraints limiting adoption of SI innovation as a result of policy. Hence this study will explore potential synergies with the aforementioned activity. In addition, since this study is focusing on competing interests for resources that could potentially hinder adoption of SI innovations, it will implicitly link to all the project activities. This is because AR strives to ensure that technologies that are being promoted by the project are adopted by the end users. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | |
| * Data from FGDs and survey * Technical leaflet and report * Journal article | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Promoters’ understanding and proper management of competing interests for natural and other household resources that are needed for SI technologies, during the dissemination process, will increase chances of adoption. We anticipate that promoters’ understanding of the competing interests will allow for better design strategies that will eliminate or minimize the effect of the competing claims. Chances of adoption will increase if these strategies are included in the package for dissemination. This will lighten the burden of decision making amongst target beneficiaries in light of the fact that there are numerous trade-offs that farmers are faced with in their day to day activities. Therefore, we anticipate that this process will allow for adoption of SI technologies to enhance resilience and adaptive capacity through reduced risks and/or increased productivity. | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers, extension agents, and policymakers | | | | | | | | | | | | | | | | |
| The primary beneficiaries include crop farmers, livestock farmers, extension agents, researchers or promoters of the SI interventions | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | | |
| **Budget Line** | | | | | | | | **CSIR-SARI** | | | | | | | | |
| Personnel | | | | | | | | 2,000 | | | | | | | | |
| Services | | | | | | | | 1,000 | | | | | | | | |
| Supplies | | | | | | | | 1,000 | | | | | | | | |
| Capital | | | | | | | | 0 | | | | | | | | |
| Travel | | | | | | | | 3,000 | | | | | | | | |
| Overhead | | | | | | | | 1,050 | | | | | | | | |
| **Total** | | | | | | | | **8,050** | | | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Month** | **2020** | | | | | | **2021** | | | |
|  | July | Aug | Sept | Oct | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Planning meeting by team |  |  |  |  |  |  |  |  |  |  |
| Draft and test of individual survey instrument |  |  |  |  |  |  |  |  |  |  |
| Roster for conducting individual surveys |  |  |  |  |  |  |  |  |  |  |
| Individual survey |  |  |  |  |  |  |  |  |  |  |
| Compile and clean Data |  |  |  |  |  |  |  |  |  |  |
| Analysis of Data |  |  |  |  |  |  |  |  |  |  |
| Write Reports |  |  |  |  |  |  |  |  |  |  |
| Participatory planning, implementation & evaluation of mitigation strategies |  |  |  |  |  |  |  |  |  |  |
| Draft Publication |  |  |  |  |  |  |  |  |  |  |

## Ghana Consolidated budget

| **Sub-activity** | **Leader** | **IITA** | **ILRI** | **IWMI** | **UDS-FA** | **WorldVeg** | **WUR** | **STEPRI** | **UDS-SH** | **KNUST** | **SARI** | **IFPRI** | **Total** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | |
| GH1111-20: Follow-up on gender evaluation of cowpea living mulch intervention | IITA | 5243.33 |  |  |  |  |  |  |  |  |  |  | 5,243 |
| GH1112-20: Optimizing on-farm nitrogen (N) fertilizer use efficiency under rainfed conditions | IITA | 199,000 |  |  |  |  |  |  |  |  | 8,050 |  | 207,050 |
| GH1113-20: Assessing the potential for a combination of local Napier fodder species and pigeon peas for improved soil health, ruminant productivity and market potential of both Napier and Pigeon pea fodder in the Guinea savannah zone; and Investigating opportunities and constraints for fodder cultivation and trade (Napier and Pigeon pea), specifically women’s and youth market participation in this part of the livestock value chain. | UDS-FA | 17,000 |  |  | 19,550 |  |  |  |  |  |  |  | 36,550 |
| GH1115-20: Identification of varieties of vegetable crop species with adaptation to Northern Ghana in the dry season | WorldVeg | 12,000 |  |  |  | 65,900 |  |  | 15,000 |  |  |  | 92,900 |
| GH1116-20: Yield and post-harvest quality of vegetables as affected by improved soil and water management practices in the dry season Northern Ghana (Niangua, Tekuru, Bonia) | WorldVeg |  |  |  |  |  |  |  |  |
| GH1121-20: Efficient feed utilization through improved feed troughs | ILRI |  | 68,437 |  |  |  |  |  |  |  |  |  | 68,437 |
| GH1122-20: Synthesize previous work on feed and health interventions for improved small ruminant production in Northern Ghana | ILRI |  | 44,862 |  |  |  |  |  |  |  |  |  | 44,862 |
| GH1123-20: Assess the effect of feeding maize leaf stripping on digestibility and growth performance of small ruminants and interactions of the technology with child labor (more specifically herding of small ruminants) and school attendance of boys and girls | UDS | 11,500 |  |  | 37,000 |  |  |  |  |  |  |  | 48,500 |
| GH1211-20: Assessing buffer and adaptive capacity to harness the resilience of different farm types | WUR |  |  |  |  |  | 0 |  |  |  |  |  | 0 |
| GH1212-20: Assess the impact of soil and water conservation interventions in maize-cowpea living mulch | KNUST | 9,000 |  |  |  |  |  |  |  | 11,680 |  |  | 20,680 |
| GH1221-20: Evaluate the technical and agronomic performance of Bhungroo and solar energy drip irrigation system in the Upper of Ghana | IWMI |  |  | 135,000 |  |  |  |  |  |  |  |  | 135,000 |
| GH1411-20: Produce regionally relevant extrapolation domain maps for validated integrated technology packages. | IITA | 11,102 |  |  |  |  |  |  |  | 2,000 |  |  | 13,102 |
| GH1412-20: Identify the sustainable agricultural intensification technologies and household characteristics that determine the maize grain yields at the different technology extrapolation domains. | IITA | 9,500 |  |  |  |  |  |  |  |  |  |  | 9,500 |
| ***Sub-total Outcome 1*** |  | *274,345* | *113,299* | *135,000* | *56,550* | *65,900* | *0* | *0* | *15,000* | *13,680* | *8,050* | *0* | *681,824* |
| Outcome 2: More farmers and farm families in the intervention communities are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition. | | | | | | | | | | | | | |
| GH2121-20: Improving Child and Maternal Nutrition through Home Container Vegetable Gardening | USDS-SH |  |  |  |  |  |  |  | 31,050 |  |  |  | 31,050 |
| GH2122-20: Engaging Men to Increase Support for Optimal Child Feeding Practices Using Care Group Approach | UDS-SH |  |  |  |  |  |  |  | 16,330 |  |  |  | 16,330 |
| GH2211-20: Evaluate the threshing efficiency of different maize shellers with regards to grain quality characteristics as influenced by different varieties and harvest timing | SARI |  |  |  |  |  |  |  |  |  | 10,005 |  | 10,005 |
| GH2212-20: Monitoring group dynamics among users of small-scale maize shelling machines in Northern Ghana | IITA | 18,000 |  |  |  |  | 9,346 | 5,750 |  |  |  |  | 33,096 |
| ***Sub-total Outcome 2*** |  | *18,000* | *0* | *0* | *0* | *0* | *9,346* | *5,750* | *47,380* | *0* | *10,005* | *0* | *90,481* |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies | | | | | | | | | | | | | |
| GH 3111-20: Strengthen the technical, managerial and organizational capacities of the major actors in small ruminants value chain through existent institutional structures such as Farmer-Based Organizations (FBO), District Assemblies (DA), Community Based Organizations (CBO), traders Associations, Transports and input Dealers Association | ILRI |  | 25,000 |  |  |  |  |  |  |  |  |  | 25,000 |
| GH3112-20: Analyze the enabling environment including policies and institutional arrangements and intervention to identify factors that enable the inclusion of women and youth along irrigated vegetable value chain | IWMI |  |  | 84,294 |  |  |  |  |  |  |  |  | 84,294 |
| GH3121-20: Assessing the inclusiveness of women and youth within the vegetable production value chain to enhance vegetable production among small holder farmers. | WorldVeg |  |  |  |  | 33,000 |  |  |  |  |  |  | 33,000 |
| GH3211-20: Evaluate risk and vulnerability as well as resilience within maize-cowpea living mulch systems in relation to smallholder farmers livelihoods | KNUST | 10,000 |  |  |  |  |  |  |  | 6,600 |  |  | 16,600 |
| GH3122-20: Assess women and the youth participation in maize and small ruminant value chains in project communities and markets the communities are linked to | IITA | 4,500 |  |  |  |  |  |  |  |  |  |  | 4,500 |
| GH3212-20: Co-identify value chain-based scaling pathways for irrigation technologies and water solutions with farmers and other actors of vegetable value chains in the Africa RISING sites in Mali and Ghana and link these sites and activities to ILSSI’s multi-stakeholder Dialogue Space on small scale irrigation in Ghana | IWMI |  |  | 98,154 |  |  |  |  |  |  |  |  | 98,154 |
| ***Sub-total Outcome 3*** |  | *14,500* | *25,000* | *182,448* | *-* | *33,000* | *-* | *-* | *-* | *6,600* | *-* | *-* | *261,548* |
|  | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at the scale of SI technologies, innovations and practices. | | | | | | | | | | | | | |
| GH4111-20: Conduct simulation and other socio-economic analyses of selected SI technologies/ practices for different farmer contexts, to have a better understanding of the adoption potential of these proven technologies and opportunities for scaling up | STEPRI |  |  |  |  |  |  | 26,450 |  |  |  |  | 26,450 |
| GH4112-20: Evaluate the impact of SI practices on household welfare, poverty, perceived shock, the environment, and food and nutrition security in northern Ghana | IITA | 2,500 |  |  |  |  |  |  |  |  |  |  | 2,500 |
| GH4113-20: Provide safety nets to smallholder farmers through crop insurance while developing a business model with multi-stakeholder partners for scaling validated technologies for equity and empowerment | IITA (plus SEEDPAG budget: $7,000) | 28,000 |  |  |  |  |  |  |  |  |  |  | 28,000 |
| GH4114-20: Evaluate farmers’ preferences for technology attributes and their associated benefits in cereal-legume systems of northern Ghana. | IITA | 7,000 |  |  |  |  |  |  |  |  |  |  | 7,000 |
| GH4121-20: Utilize ICT and GIS tools as a means to share information (agronomic, climatic and market services) and scale-out Africa RISING technologies in collaboration with strategic partnerships in the region | KNUST | 14,000 |  |  |  |  |  |  |  | 6,960 |  |  | 20,960 |
| GH4122-20: Promotion and dissemination of Africa RISING SI interventions for sustained productivity and reduced risk in Ghana using the climate-smart village approach | SARI |  |  |  |  |  |  |  |  |  | 15,444 |  | 15,444 |
| GH4311-20: Matching agricultural technologies to farmers and their context | WUR | 0 |  |  |  |  | 0 |  |  |  |  | 0 | 0 |
| GH4312-20: Investigate the distribution of benefits from diverse agricultural interventions | WUR | 18,525 |  |  |  |  |  |  |  |  |  |  | 18,525 |
| GH4313-20: Addressing constraints limiting adoption of SI technologies as a result of competing interests for natural and other household resources | SARI |  |  |  |  |  |  |  |  |  | 8,050 |  | 8,050 |
| ***Sub-total Outcome 4*** |  | *70,025* | *0* | *0* | *0* | *0* | *0* | *26,450* | *0* | *6,960* | *23,494* | *0* | *126,929* |
| **Grand total** |  | ***376,870*** | ***138,299*** | ***317,448*** | ***56,550*** | ***98,900*** | ***9,346*** | ***32,200*** | ***62,380*** | ***27,240*** | ***41,549*** | ***0*** | ***1,160,782*** |

## Mali Planned work

The planned activities are presented in protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project logframe (see Table 1).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol – Outcome 1: MA1111-20** | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainable intensified Crop-Livestock systems linked to markets. | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | |
| b. Activity 1.1.1 | | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production. | | | | | | | | | | | |
| c. Sub-activity MA1111-20 | | | | Evaluating crop simulation models using different fertility sources and climate model outputs to improve the productivity of sorghum. | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | | Role | | | | | | | |
| Birhanu Zemadim | | | | | ICRISAT | | | Activity leader | | | | | | | |
| Mathew Akinseye Folorunso | | | | | ICRISAT | | | Crop modelling and simulation analysis | | | | | | | |
| Bouba Traore | | | | | ICRISAT | | | Farming systems scientist contributing to the development of a research protocol | | | | | | | |
| Felix Badolo | | | | | ICRISAT | | | Economic analysis | | | | | | | |
| Oumar Samake | | | | | AMEDD | | | Community mobilization and multi-stakeholder interest group participation at farmers field day | | | | | | | |
| Karamoko Traore | | | | | ICRISAT | | | Field trial implementation in Koutiala | | | | | | | |
| Karamoko Sanogo | | | | | ICRISAT | | | Data collection and analysis | | | | | | | |
| Mahamadou Dicko | | | | | AMEDD | | | Field trial implementation in Bougouni | | | | | | | |
| Toumaini Sidibe | | | | | FENABE | | | Field trial implementation in Bougouni | | | | | | | |
| Benedict Boyubie | | | | | IITA | | | Monitoring and evaluation/data management | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | Institute | | | | | Degree | | Start | | | | End | |
|  | | |  | | | | |  | |  | | | |  | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | Bamako, Koutiala and Bougouni | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | April 2017 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | March 2021 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| Different fertilizer sources which combined both organic (cow and poultry manure) and inorganic fertilizer application on three sorghum varieties (Soumba, Fadda, and Tieble) were evaluated with the target of increasing productivity (grain and stover yield). Over the three (3) cropping seasons (2017 to 2019), results revealed that both grain and stover yield varied significantly among varieties, different fertilizer treatments and sources applied across three agro-ecological sites (Bamako, Bougouni, and Koutiala). Grain yield from different fertilizer treatment and sources increased by 8 to 40 % in Koutiala, 11 to 53 % in Bougouni and 44 to 110 % in Bamako respectively while average stover yields >5000 Kg/ha compared to the control across the locations. Fadda recorded the highest grain yield over Soumba and Tieble. Mean grain yield produced by Fadda was 23 % and 42 % higher than that of Soumba and Tieble varieties. Throughout cropping seasons (2017-2019), the study demonstrated a benefit of organic manure from both ruminant and non-ruminants as alternate or complementary organic fertilizer in a micro-dosing technology to boost sorghum yield productivity with significant high yielding potential. Based on the three years cropping seasons, the study, therefore, suggests to deploy the following scalable technologies:   1. Three varieties (Fadda, Soumba and Tieble) along with the multiple-choice of treatment - T2 [Cow (50g/hill) +Poultry (50g/hill)], T5 [DAP Micro-D (3g/hill)] and T9 [Poultry manure (50g/hill) for farmers in Koutiala for both high productivity and profitability. 2. Two varieties (Fadda and Soumba) along with multiple choices of fertilization strategies -T2 [Cow manure (50g/hill)+Poultry (50g/hill)]; T4 [Cow manure (100g/hill) + Micro-DAP (3g/hill)], T5 [DAP Micro-D (3g/hill)], T6- DAP41:46:00 and T9 [Poultry manure (50g/hill) respectively for maximum profitability in Bougouni and Bamako region.   Therefore, the activity for the 2020/2021 work plan consists of implementation of the identified scalable technologies in Bougouni and Koutiala districts in farmers’ fields, evaluate the gains in SI options, finalize modelling outputs and produce a manuscript for publication. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 To better understand physiological functioning and yield potential of three improved sorghum varieties (CSM63E, CSM335 and Fadda) under different fertilizer management regimes (livestock manure and inorganic fertilizer) across different rainfall gradients and soil characterizations. | | | | | | | | | | | | | | | |
| 2.2 Estimate the residual effects of nutrients on crop and water productivity. | | | | | | | | | | | | | | | |
| 2.3 Evaluate both biomass and grain yield for feed and food using the validated crop simulation models (APSIM and DSSAT) under current and future climate conditions based on observations and on Global Climate Models (GCMs) output. | | | | | | | | | | | | | | | |
| 2.4 Determine the marginal cost-benefit responses of different fertilizer sources based on current farming practices. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 How to increase sorghum productivity through optimizing fertilizer treatments (in agreement with climate smart practices) and choosing the appropriate variety? | | | | | | | | | | | | | | | |
| 3.2 Does residual organic matters lead to increased crop and water productivity, and how can such intensification pathways encompass environmental benefits? | | | | | | | | | | | | | | | |
| 3.3 What is the sensitivity of the current sorghum yield to climate change using high resolution climate Models (GCMs) outputs? | | | | | | | | | | | | | | | |
| 3.4 What rainfall gradients, physiological and soil parameters are important to create a suitable crops system model? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| Following the successful completion of experiments for three (3) years (2017-2019) across the three agro-ecological zones (Guinea Savanna, Sudan savanna and Sudano-Sahelian zone), the analysis revealed that 5 out of 9 fertility sources and treatment combinations plus three sorghum cultivars (Fadda, Soumba and Tieble) are suitable for scaling, the factors for determination of suitability included consistent increase in productivity, agronomic efficiency of nutrients and profitability. These treatment combination plus sorghum cultivars will be further tested on farmers’ fields during the 2020 cropping season for technology diffusion and adoption across the farming communities in Koutiala and Bougouni districts. A total of 40 farmers will be selected with gender considerations for a balanced approach and mobilized within two districts (Koutiala and Bougouni) with the assistance of local partners (AMEDD and FENABE) for technology validation. The protocol will follow a randomized block design and farmer fields will serve as replicates. Each farmer field will establish one improved sorghum variety and three (3) different fertilizer sources and farmer practices (FP) as control. The sorghum  varieties include Fadda, Soumba and Tieble, the fertilizer treatments will be as follows: (i) Cow manure (100g/hill), (ii) DAP 100 kg/ha + Urea(50kg/ha), (iii) DAP micro-dose (3g/hill), (iv) Cow manure (50g/hill) + poultry manure (50g/hill), and (v)Poultry manure (50g/hill) respectively. Fertilizer application will be done at sowing and 4-5 weeks after sowing. Total plot size is 20 m long x 26.3m width a total area of 526 m2 and divide the plot into 4 equal parts of (8) rows each. Each treatment plot is 8 rows (20 m long x 6m width). | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on data verse | | | | | | | | | | | | Responsibility/Institute | | | |
| Is the collected data part of a multi-year experiment/trial? Yes (4 yrs.) | | | | | | | | | | | |  | | | |
| 5.1. Agronomic (grain and Stover yield at farm level). | | | | | | | | | | | | ICRISAT/AMEDD/ FENABE | | | |
| 5.2. Economic data: cost of seed, fertilizer, cow manure, poultry manure, and labor. | | | | | | | | | | | | ICRISAT/AMEDD/ FENABE | | | |
| 5.3. Farmers participations on field day. | | | | | | | | | | | | ICRISAT/AMEDD/ FENABE | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | | Delivery date | | |
| 6.1 A report on best fertilizer management practices with higher sorghum productivity based on modelling results and farmers field validation. | | | | | | | Report uploaded on CGSPACE. | | | | | | Mar. 2021 | | |
| 6.2 Extension materials on improved Sorghum husbandry in form of poster and flyers both English or local language | | | | | | | Extension materials uploaded on CGSPACE. | | | | | | Sep. 2020 | | |
| 6.3 Report on reaching at least 400 farmers through on-farm demonstration and sensitization via farmers’ field day on fertility micro-dosing technology. | | | | | | | A report on farmers’ field day Uploaded on CGSPACE. | | | | | | Dec. 2020 | | |
| 6.4. Manuscript on fertilization management strategies for smallholder sorghum production systems in Sudanian Mali: yield and profitability variability based on analysis of agronomic data collected between 2017 and 2019. | | | | | | | Manuscript submitted for publication in Field Crops Research journal. | | | | | | Oct. 2020 | | |
| 6.5 Crop simulation Models (DSSAT and APSIM) recommendations under different fertilizer scenarios to future climatic condition. | | | | | | | Model outputs included in the technical reports to IITA. | | | | | | Dec. 2020 | | |
| 6.6 Economic benefit analysis of sorghum under different fertilizer management application and model simulation results. | | | | | | | Economic benefit analysis outputs included in the manuscript specified in section 6.4. | | | | | | Dec. 2020 | | |
| 6.7 Conference paper on modelling outputs prepared. | | | | | | | Presentation at international conference. | | | | | | Feb. 2021 | | |
| 6.8 Contributions towards development of the West Africa Handbook. | | | | | | | Chapter draft on Technology 3: Improving Sorghum Productivity using both organic manure and inorganic fertilizer applications- a case study of micro-dosing Technology in Mali sent to the chief scientist. | | | | | | Oct. 2020 | | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | |
| Domain | | Indicator | | | | Metrics/Scale | | | Approach used | | Before intervention | | | | After intervention |
| 7.1 Productivity | | Crop productivity, coefficient of variability. | | | | Kg biomass (yield, fodder)/ha/season at farm level. Number of crops grown per year on a given plot (by crop). Plant population density (seeds/ha/season or seeds/ha/year) at farm level | | | Field Experimentation | |  | | | |  |
| 7.2 Environmental | | Soil chemical properties, Soil fertility. | | | | NPK, pH, OM at plot level | | | Field data and laboratory | |  | | | |  |
| 7.3 Economic | | Profitability, variability of profitability | | | | Net income ($/crop/ha/season)  Farm-level cost-benefit analysis to determine the best fertilizer scenarios | | | Survey | |  | | | |  |
| 7.4 Social | | Equity | | | | Ranking of technologies/treatments Farmers perceptions of technologies at farm level determined during farmers field days and also through analytical and modelling approaches at plot level | | | Survey | |  | | | |  |
| 7.5 Human | | Nutrition | | | | Sorghum grain for household food production (calories/ha/year)  Number of new practices being tested or % of farmers intending to take on the new practice | | | Survey | |  | | | |  |
|  | | | | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- |
| 8. How will scaling be achieved? | | | | | |
| Scaling is done through local NGOs AMEDD and FENABE. Identification of various agronomic packages is key for scaling strategies. The use of modelling approach helps to identify the potential yield advantages of varieties over a long-term climate change. | | | | | |
|  | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | |
| The activities in the current proposal are linked through the farming system concept. Nutrient use efficiencies on crop and crop productivity are linked to activity MA1112-20. Environmental and social benefits of sorghum varieties in different ecologies are linked to activities presented in MA1211-20 and MA1212-20. | | | | | |
|  | | | | | |
| 10. Custom indicators: | | | | | |
| * Number of farmers and hectares under demonstrated technology * Number of participants in farmer’s field days * Conference paper on modelling outputs * Handbook chapter * Journal manuscript | | | | | |
|  | | | | | |
| 11. Impact-based summary matrix | | | | | |
| 11.1 What is the development challenge you are addressing?  The regions where the activity is being implemented are constrained by low soil micronutrient and productivity remains low. In addition, water is very limited which results to food and feed shortages. This activity intends to address this issue through productivity and economic efficiencies. The modelling work helps the prediction of long-term effect of climate variability on sorghum productivity, and environmental benefits. | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policy makers?  Farmers, extension agents, researchers and land use and climate change practitioners and NGOs (FENABE and AMEDD). | | | | | |
|  | | | | | |
| 12. Budget (US$) | | | | | |
| Outcome/Output/  Activity | Sub-activity | **Budget line item** | **ICRISAT** | **AMEDD** | **FENABE** |
| Outcome 1/Output 1/ Activity 1 | MA1111-20 | Personnel | 27,500 | 2,000 | 2,000 |
| Services | 10,500 | 2,000 | 2,000 |
| Supplies | 7,500 | 2,500 | 2,000 |
| Capital |  |  |  |
| Travel | 5,500 | 1,500 | 1,500 |
| Overhead (17%) | 8,670 | 1,360 | 1,275 |
|  |  | **Total** | **59,670** | **9,360** | **8,775** |
| **Total** | **77,805** | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** |
| Field experimentation/Data collection |  |  |  |  |  |  |  |  |  |  |  |
| Soil sampling and analysis |  |  |  |  |  |  |  |  |  |  |  |
| Contribution/ finalizing West Africa Handbook Chapter |  |  |  |  |  |  |  |  |  |  |  |
| Technology dissemination via field day |  |  |  |  |  |  |  |  |  |  |  |
| Crop growth measurement |  |  |  |  |  |  |  |  |  |  |  |
| Crop harvest (biomass and grain) |  |  |  |  |  |  |  |  |  |  |  |
| Data analysis and reporting |  |  |  |  |  |  |  |  |  |  |  |
| Development of conference paper, manuscript & submission |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1112-20** | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainable intensified Crop-Livestock systems linked to markets. | | | | | | | | | | | | | | |
| a. Output 1.1 | | | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | |
| b. Activity 1.1.1 | | | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production. | | | | | | | | | |
| c. Sub-activity MA1112-20 | | | | | Understanding soil fertility management in cereal cropping systems in southern Mali. | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | | Institution | | | Role | | | | | | | |
| Bouba Traore | | | | ICRISAT | | | Activity leader | | | | | | | |
| Birhanu Zemadim | | | | ICRISAT | | | Activity coordinator | | | | | | | |
| Augustine Ayantunde | | | | ILRI | | | Small ruminant scientist, provide support for crop livestock integration protocol development and technical guidance | | | | | | | |
| Benedict Boyubie | | | | IITA | | | Monitoring and evaluation/data management | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | | Institute | | | | | Degree | | Start | | | End | |
| Moumini Guindo | | | Ecole doctorale des sciences et technologies du Mali (EDSTM) | | | | | PhD | | Jan. 2019 | | | Mar. 2021 | |
| Sery Coulibaly | | | IPR/IFRA (Institut Polytechnique Rural de Formation et de Recherche Appliquée) | | | | | MSc | | Oct. 2020 | | | Mar. 2021 | |
| Moussa Camara | | | IPR/IFRA (Institut Polytechnique Rural de Formation et de Recherche Appliquée) | | | | | BSc | | Oct. 2020 | | | Mar. 2021 | |
|  | | | | | | | | | | | | | | |
| f. Location(s) | | Koutiala | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | | April 2017 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | | March 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| In Mali since decades, stakeholders including farm households and scientists are increasingly recognizing soil nutrient depletion as one of the major constraints to sustainable agricultural development. Farming systems in the country are diverse due to different climate, soils and production goals. Many complex factors are influencing the nutrient dynamics that include nutrient management, regeneration and plant protection, livestock integration, soil and water conservation, biodiversity, agricultural policies and marketing structures. These factors either alone or combined can enhance or result in soil nutrient depletion.  Farm households are confronted with deteriorating price relations between farm inputs and outputs resulting in net exploitation of soil nutrients. Due to the prevailing poverty condition, farm households have limited options for investments in nutrient-adding or nutrient-saving technologies. Nowadays, this situation is worsening due to climate change and variability. Climate-smart technologies such as organic manure use and micro-dosing application have been implemented by various actors to deal with soil nutrient depletion and climate change. Yet, there are unanswered questions about the durability of this system.  To address this issue, series of activities were undertaken in 2018 and 2019. The activities included, (i) setting up a nutrient dynamic model, NUTMON (NUTrient MONitoring) at farm level, (ii) compost and its application in a micro dosing technology was practiced in the technology park of M’Pessoba and at farmers’ field conditions, (iii) cattle corralling to evaluate productivity of dual-purpose sorghum as part of crop livestock integration activity.  The current workplan for the year 2020/2021 is prepared to finalize data collection and analysis that was started in 2018 and prepare a PhD thesis and manuscripts. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives: To optimize nutrient flow and determine the efficiency of fertility management options under sorghum cropping in Mali. | | | | | | | | | | | | | | |
| 2.1 Assessing nutrient flows and nutrient balance under different soil fertility conditions. | | | | | | | | | | | | | | |
| 2.2 Exploring and testing promising nutrient management options under sorghum cropping. | | | | | | | | | | | | | | |
| 2.3 Developing strategies for composting and improving nutrient use efficiency for sustainable soil fertility management. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What are the determinants of soil fertility and nutrient balance under different soil fertility management conditions? | | | | | | | | | | | | | | |
| 3.2 What are the farmers’ adaptation options with regards to soil nutrient depletion conditions? To what extent livestock corralling system contributes to increase soil fertility. What is the optimum deposit of nutrients content under livestock corralling system? | | | | | | | | | | | | | | |
| 3.3 How can cotton stem be used as a source of diversification for composting? What are the major constraints of producing compost with cotton stems? | | | | | | | | | | | | | | |
| 3.4 What are the main constraints for composting and how can we reduce composting period? How can application techniques for compost improve soil fertility and crop productivity? | | | | | | | | | | | | | | |
| 3.5 How can composting method improve product quality (NPK content, C/N ratio) and hence soil fertility? How does variation of planting density of dual-purpose sorghum respond to micro-dosing application of compost in technology park and in farmers’ field? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| 4.1 For mapping nutrient flow and balance, a 2 year (2018-2019) exhaustive diagnostic was conducted at farm scale involving 45 farmers from the three AR villages (Zanzoni, Sirakele and N’golonianasso) of Koutiala. The activities included typological analysis of household farming condition, farm equipment and soil nutrient quantification through laboratory analysis. The goal of the diagnostic phase is to analyze the current farming situation regarding soil nutrient depletion and economic performance. Soil samples as well as manure from different sources such as farmyard, cattle, compost etc. was collected across different farm types (typologies). Nutrient content was quantified through laboratory analysis and results are being used for capturing nutrient dynamic using NUTMON toolbox approach. The quantified nutrient flows explain which activities within a farm are nutrient consuming and which are accumulating nutrients, and how and when nutrients flow from one activity to another takes place. The quantifying financial flows give insight into the profitability of activities (crops, livestock, fishponds, compost heap and pits) and labour demands. Data collection for this activity has been completed and preliminary results were reported in the technical report submitted in March 2021. | | | | | | | | | | | | | | |
| 4.2 Exploration of promising nutrient management adaptation options at farm level together with the farmers was started in the year 2019. This includes quantifying crop-livestock interactions through a cattle corralling system. In 2020/2021 we will continue this activity with 5 agro-pastoralist in the villages of Zanzoni and Sirakele to validate the previously collected data and for modelling purpose. A total of 20 cattle will be parked respectively for 3, 7, 10 and 15 nights in a 150 m2 (15 m x 10 m) enclosure and will be used as experimental plot. Dual purpose sorghum variety (Soubatimi) with two planting densities (0.75\*0.30 and 0.75\*0.20) will follow up for confirmation as conducted in 2019/2020. Simultaneously carryover effect will be conducted on experimentation of 2019/2020 using dual purpose sorghum with no fertilizer application. | | | | | | | | | | | | | | |
| 4.3 From January to April 2019 heap compost was produced comparing two composting (1-ton cotton stem + 200 Kg cattle manure, 2-ton cotton stem + 200 Kg cattle manure) method with cotton stem. During the rainy season, field experimentation was conducted with the two compost treatments at farmer’s field as well as in the technology park of Koutiala. Each farmer experimented one of the two composting treatments. Dual-purpose sorghum variety (Soubatimi) validated by Africa RISING in 2017 and 2018 was used across all the experiment including in farmers’ fields. Compost produced was used as a micro-dosing system. The treatments include the following:   1. Zero (no application of compost and no mineral fertilizer) 2. Control practice 1 (recommended mineral fertilizer) 3. Control practice 2 (recommended mineral fertilizer micro-dosing) 4. Compost practice (farmers compost without cotton stem with spreading technique) and no fertilizer 5. Compost practice (farmers compost without cotton stem with micro-dosing technique) and no fertilizer 6. Compost practice (farmers compost without cotton stem with spreading technique) + Recommended mineral fertilizer 7. Compost practice (farmers compost without cotton stem with micro-dosing technique) + Recommended mineral fertilizer 8. Compost 1 with cotton stem (micro-dosing) + Recommended mineral fertilizer 9. Compost 1 with cotton stem (spreading)+ Recommended mineral fertilizer 10. Compost 2 with cotton stem (spreading) + Recommended mineral fertilizer 11. Compost 2 with cotton stem (micro-dosing) + Recommended mineral fertilizer   Recommended mineral fertilizer for sorghum is: 34 Kg of N/ha, 34 Kg of P/ha and 34 Kg of K/ha).  From January to April 2020 heap compost was prepared with two composting techniques (1-ton cotton stem +200 Kg cattle manure, 2 tons cotton stem +200 Kg cattle manure). During the rainy season, field experimentation with the two compost treatments will be conducted at farmer’s field as well as in the technology parks. Each farmer will be experimenting one of the two composting treatments. Dual purpose variety will be used across all the experiment including in farmer field. This experimentation will complete the data collection that started in 2019 as at least two years data is required for completing the PhD thesis, validating NUTMON model and write manuscripts. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | Responsibility/ Institute | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes (4 yrs.) | | | | | | | | | |  | | | | |
| 5.1 Resource inventory, farm characterization, nutrient flow | | | | | | | | | | ICRISAT | | | | |
| 5.2 Soil physio-chemical analysis, Crop grain and biomass yield etc. | | | | | | | | | | ICRISAT | | | | |
| 5.3 For chemical characterization: pH (1: 2.5 H2O), Total organic carbon, total NPK, calcium, magnesium, C/N ratio will be determined in the laboratory at maturation time of the compost. | | | | | | | | | | ICRISAT | | | | |
| 5.4 Crop yield across treatments, labor, economic data. | | | | | | | | | | ICRISAT | | | | |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | Means of verification | | | | Delivery date | | |
| 6.1 Household level nutrient flow data. | | | | | | | | Data uploaded on CGSPACE. | | | | Mar. 2021 | | |
| 6.2 A report on modelled results on nutrient flow characterized across farm typologies. | | | | | | | | Report uploaded on CGSPACE. | | | | Mar. 2021 | | |
| 6.3 Methodological report on composting technology. | | | | | | | | Summary report included in the Africa RISING technical report submitted to IITA. | | | | Mar. 2021 | | |
| 6.4. Manuscript on integrated soil fertility management practices under different input and nutrient flow conditions. | | | | | | | | Manuscript submitted to Nutrient Cycling in Agroecosystems journal. | | | | Mar. 2021 | | |
| 6.5 Contributions towards development of the West Africa Handbook. | | | | | | | | Revised chapter on Technology 6:Heap Composting Process for soil fertility management sent to Chief scientist. | | | | Oct. 2020 | | |
|  | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | |
| Domain | Indicator | | | | | Metrics/Scale | | | Approach used | | Before intervention | | | After intervention |
| 7.1 Productivity | Crop Productivity, Variability of production | | | | | Yield at plot level, above-ground biomass (t/ha) at farm level | | | Field Experimentation | |  | | |  |
| 7.2 Environmental | Soil chemical quality  Soil nutrients | | | | | NPK, pH, total organic matter at farm level | | | Field data and laboratory | |  | | |  |
| 7.3 Economic | Profitability, variability of profitability | | | | | Net income at farm level, % of production sold (by crop, animal product), % of total income from agriculture at farm level | | | Survey | |  | | |  |
| 7.4 Social | Gender Equity | | | | | Farmer group work, access to information, % of labor involved in the activity, ranking of technologies at farm level, Literacy and numeracy of adults, % of men and women literate at household level | | | Survey | |  | | |  |
| 7.5 Human | Nutrition | | | | | Diversity of crops grown (% of all land) disaggregated by consumption versus sale at field level, capacity to learn | | | Survey | |  | | |  |
|  | | | | | | | | | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8. How will scaling be achieved? | | | | |
| Developed technologies will be made available for scaling through training of farmers in different villages and for extension workers. Reports, technical documents and scientific papers developed with the activity will help to disseminate the technology widely. | | | | |
|  | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | |
| This is farming system research including soil fertility management, crop management, and socioeconomic analysis. Results can be used by other activities for further understanding of nutrient management under different soil fertility condition. It is therefore linked to MA1111-20 and MA1113-20. | | | | |
|  | | | | |
| 10. Custom indicators | | | | |
| * Two training sessions will be organized in each of the three villages * Manuscript submitted * Technology Handbook * PhD thesis * MSc thesis | | | | |
|  | | | | |
| 11. Impact-based summary matrix | | | | |
| 11.1 What is the development challenge you are addressing?  This activity will address nutrient management issues under low soil fertility management as well as evaluation of the contribution of livestock corralling system on improving soil fertility management. | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Extension agents, farmers and NGO. | | | | |
|  | | | | |
| 12. | | | | |
| Outcome/Output/Activity | Sub-activity | **Budget line item** | **ICRISAT** | **AMEDD** |
| Outcome 1/Output 1/ Activity 1 | MA1112-20 | Personnel | 22,500 | 2,000 |
|  | | Services | 8,500 | 2,000 |
| Supplies | 13,500 | 2,500 |
| Capital |  |  |
| Travel | 9,500 | 1,500 |
| Overhead (17%) | 9,180 | 1,360 |
| **Total** | **63,180** | **9,360** |
| **Total** | **72,540** | | | |

13. Gantt Chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Discussing experimental protocol with technicians and local NGOs |  |  |  |  |  |  |  |  |  |  |
| Farmers field (identification, planting) |  |  |  |  |  |  |  |  |  |  |
| Crop growth measurement |  |  |  |  |  |  |  |  |  |  |
| Crop harvest (biomass and grain) |  |  |  |  |  |  |  |  |  |  |
| Soil sampling and analysis |  |  |  |  |  |  |  |  |  |  |
| Training |  |  |  |  |  |  |  |  |  |  |
| Data analysis and reporting, manuscript preparation |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1113-20** | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | |
| a. Output 1.1 | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | |
| b. Activity 1.1.1 | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production. | | | | | | | | | |
| c. Sub-activity MA1113-20 | | Testing adaptation of dual purposes sorghum hybrids in Mali to diversify options for crop-livestock integration. | | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | | Institution | | Role | | | | | | | |
| Baloua Nebie | | ICRISAT | | Activity leader | | | | | | | |
| Felix Badolo | | ICRISAT | | Economic analysis | | | | | | | |
| Mamourou Sidibe | | ICRISAT | | Implementation of field activities | | | | | | | |
| Birhanu Zemadim | | ICRISAT | | Activity coordinator | | | | | | | |
| Madina Diancoumba | | ICRISAT | | Crop modeler | | | | | | | |
| Nadine Worou | | ICRISAT | | Support crop modeling work | | | | | | | |
| Benedict Boyubie | | IITA | | Monitoring and evaluation/data management | | | | | | | |
|  | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | |
| Name | Institute | | | Degree | | | Start | | | End | |
| To be identified | IPR/IFRA Katibougou | | | MSc | | | Jul. 2020 | | | Mar. 2021 | |
|  | | | | | | | | | | | |
| f. Location(s) | Bougouni and Koutiala | | | | | | | | | | |
|  | | | | | | | | | | | |
| g. Start | June 2019 | | | | | | | | | | |
|  | | | | | | | | | | | |
| h. End | March 2021 | | | | | | | | | | |
|  | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| In Mali, sorghum and millet are used by farmers as staple food, especially in the rural areas. With the continual increase of livestock coupled with the diminishing natural pastures, crop residues are playing an important role in animal feeding, especially during the dry season. Most farmers are using landrace residues as fodder but the quantity and especially the quality of this feed is limited/poor. The stems are tall and hard due to high lignin content which negatively influences fodder digestibility and animals are only able to eat the top of the stem. New varieties of sorghum (such as Soubatimi, Tiandougoucoura, Peke) combining grain yield (~2t/ha), fodder yield (15 to 20 t/ha for fresh stover) and quality (green leaves until grain maturity) were developed (CEDEAO-UEMOA-CILSS, 2016[[54]](#footnote-54)). These varieties were tested in the Africa RISING technology parks as well as on-farm in Mali and farmers are now growing them for both grains (for household consumption) and fodder (livestock feeding). These varieties showed at least high grain yield over the local check (Africa RISING 2019 technical report and publication[[55]](#footnote-55);[[56]](#footnote-56)) in each zone and stover quality is also much higher given their stay-green trait and also the low lignin of the stem.  Based on the evidences highlighted above and also on the hybrids yield advantage which was reported to be up to 30 % compared to the local variety across different production conditions in farmers’ field in Mali[[57]](#footnote-57), a second year agronomic activity (2020 agronomic season) on the dual-purpose sorghum hybrids is essential to diversify the type of cultivars farmers are exposed to, for increasing production, and prepare a manuscript for publication. The hybrids proposed in this study were selected from a set of 34 varieties based on grain yield and farmers’ preferences in different zones. They showed at least 10% of grain yield advantage compared to Fadda (released hybrid) and at least 20% compared to Tieble (stable farmers preferred variety). Testing dual-purpose hybrids will provide more options to farmers by keeping stover quality and increasing grain yields as compared to the OPVs dual-purpose sorghums. The activity will be implemented in the four technology parks in Mali with 4 new hybrids compared to Fadda (released hybrid used as dual purpose) and a local variety. Thus, an agronomic trial established in 2019 need to be repeated for 2020 to finalize preparation for parameterizing dual-purpose sorghum varieties in APSIM and DSSAT models. Modelling efforts enable identification of major water stress scenarios affecting crop growth and development in sorghum production region and then to contribute to preventing the risks of production of dual-purpose sorghum varieties. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 Identify dual purpose sorghum hybrids adapted to Africa RISING target zones in Mali and assess the resilience of sorghum cropping systems with respect to alternative fertility management practices combined with variety improvement options and seasonal climate variability in climate change scenarios. | | | | | | | | | | | |
| 2.2 Identify farmers preferred sorghum hybrids for future scaling in the target zones. | | | | | | | | | | | |
| 2.3 Assess economic advantages of new hybrids compared to local varieties. | | | | | | | | | | | |
| 2.4 Identify the major stress scenarios that could affect dual purpose sorghum during the growing period. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 Which of the dual-purpose sorghum hybrids are well adapted to Africa RISING targeted zones and beyond? | | | | | | | | | | | |
| 3.2 Are there stable hybrids for the two Africa RISING intervention districts in Mali, adapted to the environmental conditions and preferred by farmers or specific material is needed for each district? | | | | | | | | | | | |
| 3.3 What is the relation between farmers’ preferences and agronomic traits? | | | | | | | | | | | |
| 3.4 What economic advantage hybrids have compared to farmers’ best variety in each zone? | | | | | | | | | | | |
| 3.5 How best can crop modeling contribute to the identification of the optimum production region of farmer preferred varieties? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | |
| Four new dual-purpose sorghum hybrids will be evaluated in the Africa RISING technology parks in Mali (4 locations). In each location, the trial will be implemented following Fisher block design with 3 replications, 6 rows of 3 m per plot. The distances between rows will be 75 cm and between hills, 30 cm. DAP (100 Kg/ha) and Urea (50 Kg/ha) will be applied after respectively 15 days and 40 to 50 days after sowing. To enable comparison between improved variety and local one in the target zone, farmers preferred variety will be included as local check in all the trials. The field conditions, agronomic data and farmers’ preferences will be recorded at the appropriate periods and following the implementation protocol. Farmers’ evaluation will be done at grain maturity, few days before harvesting. | | | | | | | | | | | |
| 4.1 Preparation of field protocols and seed packs for the trials | | | | | | | | | | | |
| 4.2 Training of technicians on trial implementation | | | | | | | | | | | |
| 4.3 Farmers evaluation (preferences) of hybrids in each technology park and farmers field | | | | | | | | | | | |
| 4.4 Data collection and analysis following the protocol | | | | | | | | | | | |
| 4.5 Variety parametrization and simulation setup and runs:The sorghum crop-growth model in Agricultural Production Systems Simulator (APSIM) and the Decision Support System for Agrotechnology Transfer (DSSAT) models will be used to perform simulations. The models will be provided with inputs of meteorological dataset (daily rainfall, maximum and minimum temperatures and solar radiation), soil data (soil water characteristics, data on soil nitrogen etc.), crop parameters (phenology data, canopy data and stover and grain yield data) and crop management options (sowing date, fertilizer type and application time, sowing density etc.). Once the model set-up was finalized, the APSIM model will be run across the sorghum production region of Mali over 15 minimum years (ideally 30 years) in order to identify the major stress scenarios impacting its performance in those bands. The DSSAT model will be used to assess the resilience of sorghum cropping systems with respect to alternative fertility management practices combined with variety improvement options. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | Responsibility | | | |
| Is the collected data part of a multi-year experiment/trial? Yes (second year data) | | | | | | | |  | | | |
| 5.1 Field characterization (soil type, cropping system, etc.) + rainfall and GPS data | | | | | | | | ICRISAT | | | |
| 5.2 Farmers preferences for varieties | | | | | | | | ICRISAT | | | |
| 5.3 Grain yield and stover yields | | | | | | | | ICRISAT | | | |
| 5.4 Stover biochemical composition | | | | | | | | ICRISAT | | | |
| 5.5 Plot survey (yields and input costs) | | | | | | | | ICRISAT | | | |
| 5.6 Map of trial locations on-farm/parks | | | | | | | | ICRISAT | | | |
| 5.7 Agronomic and physiological data for APSIM and DSSAT parametrization of | | | | | | | | ICRISAT | | | |
|  | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | |
| Deliverables | | | | | Means of verification | | | | | Delivery date | |
| 6.1 Scientific article with 2 years data)  Title: Agronomic and economic performance of dual-purpose sorghum varieties in Bougouni and Koutiala zones in Mali. | | | | | Article submitted to Field Crops Research journal. | | | | | May 2021 | |
| 6.2 Report on farmers’ perception of varieties. | | | | | Report uploaded on CGSPACE. | | | | | Mar. 2021 | |
| 6.3 Report on scenarios affecting the dual-purpose sorghum varieties production in Mali | | | | | Report uploaded on CGSPACE. | | | | | Mar. 2021 | |
| 6.4 Contributions towards development of the West Africa Handbook | | | | | Revised chapter on Technology 2: Sorghum hybrids (Pablo, Fadda and Sewa) sent to the chief scientist. | | | | | Oct. 2020 | |
|  | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | |
| Domain | Indicator | | Metrics/Scale | | | Approach used | | | Before intervention | | After intervention |
| 7.1 Productivity | Crop productivity | | Grain yield & stover yield in Kg/ha at plot level | | | Field Experimentation | | |  | |  |
| 7.2 Environmental | Soil chemical properties,  soil nutrients | | NPK, pH, total organic matter at farm level | | | Field data and laboratory | | |  | |  |
| 7.3 Economic | Profitability  Variability of profitability | | Net income at farm level  % of production sold (by crop) at farm level  % of total income from agriculture at farm level | | | Survey | | |  | |  |
| 7.4 Social | Gender Equity | | Farmers’ rating of technology at farm level | | | Survey | | |  | |  |
| 7.5 Human | Nutrition  Food security | | Micronutrient (Fe/Zn) production (g/ha) at plot level; Availability of food at household level | | | Survey | | |  | |  |
|  | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- |
| 8. How will scaling be achieved? | | | | | |
| The trials will be implemented in the technology parks located in Koutiala (M’Pessoba and N’golonianasso) and Koutiala (Madina and Flola) in Mali, so exposed to farmers and other end users such as processors and seed traders. During the evaluations of the trials in the technology parks, the best hybrids identified by farmers will be released later for seed production and commercialization in different zones by farmers’ organizations and local private seed companies. Local seed cooperatives and seed companies, extensions services (Agriculture services and NGOs) and rural radios will be associated to the field visit to ensure seed availability when a given hybrid has been identified to reach 2,000 farmers. | | | | | |
|  | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | |
| This activity is focused on yield-increasing and crop-livestock integration (dual-purpose sorghum). It is therefore linked to MA1121-20: Efficient feed utilization through improved feed troughs, MA1122-20: Fodder production for improved ruminant productivity, and MA1131-20: Risk management and informed decision making towards sustainable intensification of crop-livestock systems. | | | | | |
|  | | | | | |
| 10. Custom indicators | | | | | |
| * Number of improved technologies exposed to farmers’ appreciation (target = 4) * Number of stakeholders reached with innovative approaches/methods (target = 100, FtF Indicator 1.4) * Number of beneficiaries trained (at multiple scales: farmer, extension, researchers, students, other stakeholders, policymakers (target = 50, FtF Indicator 2.4) * Number of farmers evaluating dual-purpose hybrid sorghum (target = 30, FTF Indicator 2.10 modified) | | | | | |
|  | | | | | |
| 11. Impact-based summary matrix | | | | | |
| 11.1 What is the development challenge you are addressing?  Sorghum producers still have low yields and most of them use local varieties since they are not adequately exposed to improved varieties and hybrids. Increasing of human populations often drive up demand for food production which typically results in the expansion of cropland particularly in the absence of adequate food production technology. The availability of animals feed continues to be a challenging issue and crops residues are the most used during the dry season. Farmers are now looking for cultivars with high grain yield and grain quality for the household nutrition as well as quality stover for livestock feeding. | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The activity targets male and female farmers for their food security and also animal feeding. This category of farmers are sorghum growers but also have animals which are nourished during the off-season with crop residues. Men are often in charge of big animals (cows and donkey) and in certain zone small ruminant too. Women are in general managing small ruminants (sheep, goals). | | | | | |
|  | | | | | |
| 12. Budget (US$) | | | | | |
| Outcome/Output/Activity | Sub-activity | **Budget line item** | **ICRISAT** |  |  |
| Outcome 1/Output 1/ Activity 1 | MA1113-20 | Personnel | 34,500 |  |  |
| Services | 8,500 |  |  |
| Supplies | 5,500 |  |  |
| Capital |  |  |  |
| Travel | 6,500 |  |  |
| Overhead (17%) | 9,350 |  |  |
|  |  | **Total** | **64,350** |  |  |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Finalizing technology Handbook |  |  |  |  |  |  |  |  |  |  |
| Seed and fertilizer preparation |  |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |  |
| Training on postharvest management |  |  |  |  |  |  |  |  |  |  |
| Data cleaning and analysis |  |  |  |  |  |  |  |  |  |  |
| Scientific article writing |  |  |  |  |  |  |  |  |  |  |
| Mapping of trials locations on-farm/park |  |  |  |  |  |  |  |  |  |  |
| Report on farmers perception on hybrids sorghum |  |  |  |  |  |  |  |  |  |  |
| Variety parametrization with APSIM and DSSAT |  |  |  |  |  |  |  |  |  |  |
| Scientific article writing and submission |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1114-20** | | | | | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | | | | |
| b. Activity 1.1.1 | | | | | Test a combination of climate-smart crop varieties and agronomic practices to increase and sustain food and feed production. | | | | | | | | | | | | | | |
| c. Sub-activity MA1114-20 | | | | | Evaluate and disseminate technologies to control vegetable pests and diseases, reduce postharvest losses and improve human nutrition | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | | | | |
| Name | | | | | Institution | | Role | | | | | | | | | | | | |
| Jean Baptiste Tignegre | | | | | WorldVeg | | Sub-activity leader: design protocols; data analysis and report writing | | | | | | | | | | | | |
| Wubetu Legesse | | | | | WorldVeg | | Data analysis on pests and diseases | | | | | | | | | | | | |
| Edoh Kukom | | | | | Consultant | | Implementing postharvest and processing training | | | | | | | | | | | | |
| Alpha Sidy Traore | | | | | WorldVeg | | Supervise field work and collect data | | | | | | | | | | | | |
| Gundula Fischer | | | | | IITA | | Design and implement gender studies on vegetable production | | | | | | | | | | | | |
| Felix Badolo | | | | | ICRISAT | | Perform comparative cost benefit analysis over seasons | | | | | | | | | | | | |
| Bougouna Sogoba | | | | | AMEDD | | Community mobilization and technology dissemination in Koutiala | | | | | | | | | | | | |
| Sidibe Toumani | | | | | FENABE | | Community mobilization and technology dissemination in Bougouni | | | | | | | | | | | | |
| Mahamadou Dicko | | | | | AMEDD | | Contribute in organizing gender survey activities | | | | | | | | | | | | |
| Benedict Boyubie | | | | | IITA | | Monitoring and evaluation/data management | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| e. Student (s) | | | | | | | | | | | | | | | | | | | |
| Name | | Institute | | | | | | | | Degree | | | | Start | | | End | | |
| Moussa Kanoute | | University of Ouagadougou, Burkina Faso | | | | | | | | PhD | | | | 2019 | | | 2021 | | |
| Raki Diallo | | University of Bamako, Mali | | | | | | | | PhD | | | | 2019 | | | 2021 | | |
|  | | | | | | | | | | | | | | | | | | | |
| f. Location(s) | | Koutiala and Bougouni | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| g. Start | | April 2017 | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| h. End | | September 2021 | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | | | | |
| Demonstration on adapted storage prototypes and processing technologies will be carried out in the technology parks/lead hubs to reduce postharvest losses, avail healthy products and improve income. Diseases, pests and postharvest assessments will be implemented with farmers’ preferred vegetable varieties and species. Demonstrations on postharvest and processing technologies and diseases screening trials will be carried out in two technology parks in Bougouni and Koutiala. In each park, improved/validated vegetable varieties and local varieties (validated or improved varieties vs. adapted local variety) will be compared for disease and pest resistance and postharvest losses. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | | | | |
| 2.1 Introduce, evaluate, adapt and disseminate existing variety disease and pest resistance management, postharvest technologies and practices. | | | | | | | | | | | | | | | | | | | |
| 2.2 Introduce, evaluate, adapt and disseminate good agricultural practices in home vegetable gardening, to improve nutrition for households. | | | | | | | | | | | | | | | | | | | |
| 2.3 Build capacity of farm families to reduce diseases and pest damages and postharvest losses. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 3. Research questions/hypotheses | | | | | | | | | | | | | | | | | | | |
| 3.1 Leaf and/or fruit yield, pest and disease resistances under adapted storage condition of improved varieties vegetable varieties will improve significantly as compared to those of local varieties under irrigated conditions. | | | | | | | | | | | | | | | | | | | |
| 3.2 The food diversity score of sack garden beneficiaries is improved. | | | | | | | | | | | | | | | | | | | |
| 3.3 The preference of vegetable species and varieties is gender-neutral. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 4. Procedures | | | | | | | | | | | | | | | | | | | |
| Sub-activity MA1114-2001: Conduct indigenous and exotic vegetable disease-resistance trials in the dry season (September 2020). | | | | | | | | | | | | | | | | | | | |
| For this sub-activity, two years of agronomic data were collected but the disease and pest characterization and assessment, the postharvest assessment started in 2020 and need a second year to avail two or more years’ data. These activities will be conducted in the technologies parks where postharvest storage facilities were installed in 2020.  This sub activity integrates production, disease assessment and control, nutrition, gender equity and economic research. Integrated pest management (IPM) and postharvest assessments for different crop species and improved varieties vs. local varieties will be conducted to test or disseminate tomato, eggplant and vegetable cowpea to select high-yielding, and disease-resistant varieties with long shelf life. The field design will be randomized complete blocks with 4 replicates in the technology parks combined across 2 locations (Bougouni, Koutiala). The technology parks will host the replicated trials. In addition, a nursery of 26 new tomato and 14 new pepper varieties will be established in the lead hubs to enable preliminary participatory selection by farmers with regards to diseases and yield performance, market, food and feed suitability. Two field days will be organized for knowledge sharing on IPM, and best postharvest practices. Data will also be collected on dry season trials and demonstrations. A survey will be implemented to document gender preferences for onion and vegetable cowpea. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| Sub-activity MA1114-2002: Test and demonstrate vegetable performance using sack gardens to enable more access to vegetables and generate income for women farmers in the dry season (November 2020). | | | | | | | | | | | | | | | | | | | |
| This activity was conducted in 2020 but needs two years’ research data (2020 and 2021) to achieve useful output.  The deployment of sack gardens aims at enabling vegetable production by women with no access to land or to a reliable water source for normal gardening. It involves recycled fertilizer bags as containers filled with soil and compost serving as plant substrate. It promotes space and water use efficiency and that a diverse range of legumes species can be grown in a confined space. Three to four cycles of production are possible annually. In the household it appears as source of food and ornamentals. The access to sack gardens is easy for all social categories in rural areas and urban and peri-urban farmers. Forty farmers in two districts (Bougouni and Koutiala) will test African eggplant, tomato, onion, amaranth, cabbage, carrot and vegetable cowpea, using 50kg-content recycled fertilizer sacks in the dry season. Fifty farmers in each district will plant 25-30 vegetable seedlings of amaranth, African eggplant, tomato, cabbage, onion, carrot and vegetable cowpea on the open top of the sacks in horizontal position.  The garden design will be randomized blocks with 4 replicates in two technology parks across 2 locations (Bougouni and Koutiala); non-lead farmers will test a single replicate of tomato, amaranth, African eggplant, onion, cabbage, carrot, and vegetable cowpea. Data will be collected for leafy and fresh fruits, input & labor costs, varietal performance against plant diseases, plant turgor retention, leaf index area, soil moisture, farmers’ perceptions on varieties (tomato, amaranth, African eggplant, onion, cabbage, vegetable cowpea, etc.) and sack gardening. The effect of sack gardening on food security for households will be assessed. This activity is an integrated approach that involves nutrition, production and economic interventions. It is linked to post-harvest subactivity MA2211-2021 and MA2221-20. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | Responsibility/Institute | | | | | | | |
| 5.1 Days to 50 % flowering | | | | | | | | | | | | WorldVeg/AMEDD | | | | | | | |
| 5.2 Number of plants bearing fruits per plot; fruit, bulbs and leaf yields (kg/ha) | | | | | | | | | | | | WorldVeg/AMEDD | | | | | | | |
| 5.3 Disease & pest incidence (fungi, bacteria, virus, whiteflies, thrips, aphids, mites), new resistance sources | | | | | | | | | | | | WorldVeg | | | | | | | |
| 5.4 Daily temperatures & humidity of ZECC, shelf-life duration (days), weight loss, quality parameters (TSS, acidity and color), etc. | | | | | | | | | | | | WorldVeg | | | | | | | |
| 5.5 Temperature & relative humidity, drying rate, moisture content and color | | | | | | | | | | | | WorldVeg | | | | | | | |
| 5.6 Gender preferences for vegetable varieties | | | | | | | | | | | | IITA | | | | | | | |
| 5.7 Farmers’ perception on sack gardening and its effect on food security | | | | | | | | | | | | ICRISAT | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | | Means of verification | | | | | | | Delivery date | | | |
| 6.1 Report on high performing vegetable varieties with farmers’ preferred traits | | | | | | | | | Summary report included in Africa RISING technical report | | | | | | | May 2021 | | | |
| 6.2 Report on new disease-resistant tomato & pepper varieties identified in Bougouni & Koutiala districts | | | | | | | | | Summary report included in Africa RISING technical report | | | | | | | May 2021 | | | |
| 6.3 Report on major vegetable diseases identified for Bougouni & Koutiala districts | | | | | | | | | Summary report included in Africa RISING technical report | | | | | | | May 2021 | | | |
| 6. 4 Report on Farmers Field Days & participatory variety selection | | | | | | | | | Report uploaded on CGSPACE | | | | | | | Mar. 2021 | | | |
| 6.5 Report on farmers training and trial establishment | | | | | | | | | Summary report included in the Africa RISING technical report | | | | | | | Sep. 2021 | | | |
| 6.6 Database on vegetable diseases, pests assessment, and performance of household sack gardens | | | | | | | | | Uploaded on Dataverse | | | | | | | Sep. 2021 | | | |
| 6.7 A report of food security assessment | | | | | | | | | Report included in the Africa RISING technical report | | | | | | | Sep. 2021 | | | |
| 6.8 A report on establishment of gender preference for onion & vegetable cowpea varieties | | | | | | | | | Report included in the Africa RISING technical report | | | | | | | Sep. 2021 | | | |
| 6.9 Finalization of the West Africa Handbook in collaboration with the co-authors as a team | | | | | | | | | Handbook chapter submitted | | | | | | | Oct. 2020 | | | |
| 6.10 Submit publication of two articles on sustainable intensification of vegetables in Mali and Ghana | | | | | | | | | Submitted to sustainability journal | | | | | | | Oct. 2020 | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | | | | | |
| Domain | | | Indicator | | | Metrics/Scale | | Approach used | | | | | Before intervention | | | | | After intervention | |
| 7.1 Productivity | | | Crop productivity | | | Fruit yield and fodder yield (Kg/ha) at farm level | | Field experimentation.  Evaluate fruit weight & yield of control variety | | | | |  | | | | |  | |
| 7.2 Environmental | | | Diseases scores  Crop postharvest losses | | | Number of species & varieties at field/plot level | | Field experimentation.  Compare variety diseases & pest incidence scores vs. check | | | | |  | | | | |  | |
| 7.3 Economic | | | Profitability | | | Net income/ha at plot and farm level | | Survey – questionnaire | | | | |  | | | | |  | |
| 7.4 Social | | | Gender equity | | | Access to land, market & preference for varieties at household level | | Survey – questionnaire | | | | |  | | | | |  | |
| 7.5 Human | | | Nutritional analysis of crops tested for adaptation and postharvest losses | | | Nutrient content in tomato & onion under different fertilizer dose application at plot level | | Nutritional component and quality analysis | | | | |  | | | | |  | |
|  | | | | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | | | | |
| Scaling activities in 2020-2021 will include partnership with development partners (AMEDD, FENABE, Women farmers’ associations in Koutiala and Bougouni, NARS). Knowledge transfer and scaling strategies will include establishment of research-for-development plots to demonstrate technologies; participatory and joint learning approaches for variety selection in the community-based technology parks as well as farm fields; development by WorldVeg of training of trainers and hands-on training for farmers. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | | | |
| This activity is an integrated approach that involves nutrition, production and economic interventions. It is linked with post-harvest sub-activity MA2211-20. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | | | | |
| * Number of farmers for whom the technology is affordable * Number of farmers for whom the technology is available locally | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  (i) Low access to quality seeds and improved varieties, (ii) high pressure of diseases & pests without effective control methods and uses of banned pesticides, (iii) high postharvest losses by household farmers due to low access to affordable storage facilities, (iv) high rates of malnutrition prevailing for women and infants due to low consumption of vegetables, (iv) low access to land and markets by women, (v) weak linkage to vegetable markets. | | | | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The targeted audience is farmers, extension agents, NGOs, farmers’ associations, local community leaders and policymakers. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| Outcome/  Output/Activity | Sub-activity | | | **Budget line item** | | | **WorldVeg** | **ICRISAT** | | |  | | | | **AMEDD** | | | |  |
| Outcome 1/Output 1/  Activity 1 | MA1114-20 | | | Personnel | | | 25,000 | 5,000 | | |  | | | | 2,000 | | | |  |
| Services | | | 18,000 | 5,000 | | |  | | | | 2,000 | | | |  |
| Supplies | | | 12,570 | 3,000 | | |  | | | | 1,000 | | | |  |
| Capital | | | - |  | | |  | | | |  | | | |  |
| Travel | | | 11,000 | 3,000 | | |  | | | | 1,000 | | | |  |
| Overhead (22.1% for WorldVeg) | | | 14,645 | 2,720 | | |  | | | | 1,020 | | | |  |
|  |  | | | **Total** | | | **81,215** | **18,720** | | |  | | | | **7,020** | | | |  |
| **Grand total** | **106,955** | | | | | | | | | | | | | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month/ Week** | **2020** | | | **2021** | | | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** |
| Planting nurseries and transplanting |  |  |  |  |  |  |  |  |  |  |  |  |
| Field preparation and Training |  |  |  |  |  |  |  |  |  |  |  |  |
| Storage facilities construction & trial start |  |  |  |  |  |  |  |  |  |  |  |  |
| Finalizing Handbook book chapters |  |  |  |  |  |  |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  |  |  |  |  |  |  |
| Data analysis and report writing |  |  |  |  |  |  |  |  |  |  |  |  |
| Field day |  |  |  |  |  |  |  |  |  |  |  |  |
| Participatory technologies selection (varieties, storage management options) |  |  |  |  |  |  |  |  |  |  |  |  |
| Data upload in dataverse |  |  |  |  |  |  |  |  |  |  |  |  |
| Conduct gender & economic surveys |  |  |  |  |  |  |  |  |  |  |  |  |
| Manuscript preparation and submission |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1121-20** | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | | Research products for more productive, intensive, diverse, profitable and resilient crop (cereals, legumes, and vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | |
| b. Activity 1.1.2 | | | | Test and disseminate a combination of improved breeds, housing, feeding, health and breeding practices to intensify rearing of livestock (sheep, goat, pig, and poultry) for meat, egg and milk production. | | | | | | | | | | | |
| c. Sub-activity MA1121-20 | | | | Evaluate efficient feed utilization through improved feed troughs. | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | Institution | | | | Role | | | | | | | | | |
| Augustine Ayantunde | | ILRI | | | | Coordination of sub-activity, data analysis and final report | | | | | | | | | |
| Theophile Dembele | | AMEDD | | | | Coordinate training of farmers, data collection and report of the training | | | | | | | | | |
| Koita Seydou | | AMEDD | | | | Data collection and entry | | | | | | | | | |
| Oumar Samake | | AMEDD | | | | Supervise AMEDD activities | | | | | | | | | |
| Bougouna Sogoba | | AMEDD | | | | Coordinate design of a feed trough prototype | | | | | | | | | |
| Benedict Boyubie | | IITA | | | | Monitoring and evaluation/data management | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | Institute | | | | | | Degree | | Start | | | | End | | |
|  |  | | | | | |  | |  | | | |  | | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | M’Pessoba, Sirakele and Zanzoni in Koutiala district | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | October 2018 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | March 2021 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| Data has been collected on the use of improved feed troughs for small ruminants in M’Pessoba, Sirakele and Zanzoni in Koutiala district involving 45 farmers between January 2019 and March 2020. A technical report has been prepared from the preliminary results from data collected in the late dry season (March/April 2019) and early dry season (February 2020). The results showed that the improved feed troughs reduced feed waste significantly in all the study communities. The percentage of waste in feeding crop residues to the animals using the traditional feed troughs were 7.73±0.92, 26.13±3.30, and 13.32±1.39 in Sirakele, Zanzoni and M’Pessoba, respectively in the late dry season compared to less than 1% with the improved feed troughs during the same season in Sirakele and M’Pessoba, respectively and 3.33% in Zanzoni which implies about 7%, 23% and 12% feed saved in Sirakele, Zanzoni and M’Pessoba, respectively. Similar trends were observed in the early dry season. The results look promising and can be used to produce a good paper which is the focus of this sub-activity. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 The objective of this sub-activity is to produce a journal article on efficient feed utilization through improved feed troughs in southern Mali for publication in a journal. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 Do seasons affect the quantity of feed that could be saved through improved feed troughs? | | | | | | | | | | | | | | | |
| 3.2 Do improved feed troughs lead to reduction in time spent in feeding the animal? | | | | | | | | | | | | | | | |
| 3.3 Who are the adopters of the improved feed troughs and what are the drivers of adoption? What are the constraints to the adoption by non-adopters? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.). | | | | | | | | | | | | | | | |
| The data collected in the late dry season (March/April 2019) and early dry season (February 2020) will be analyzed and a manuscript will be drafted based on the results from the data analysis. The manuscript will be submitted to a French journal *Revue d’élevage et de médecine vétérinaire des pays tropicaux* for publication, which is widely accessed by researchers in the Francophone countries. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | Responsibility/Institute | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | |  | | | | | |
| 5.1 No new data will be collected as this sub-activity will be using data already collected to prepare a manuscript. | | | | | | | | | | ILRI | | | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | Delivery date | | | | |
| 6.1 Draft manuscript on efficient feed utilization through improved feed troughs for small ruminants in southern Mali | | | | | | Manuscript submitted to a journal | | | | | Oct. 2020 | | | | |
| 6.2 Published journal article | | | | | | Journal | | | | | Mar. 2021 | | | | |
| 6.3 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | Handbook revisions | | | | | Oct. 2020 | | | | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | |
| Domain | | | Indicator | | | | | Metric and scale | | | | | | | |
| Not applicable for a draft manuscript | | |  | | | | |  | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| Publication of the results from the testing and evaluation of the use of the improved feed troughs in a scientific journal will facilitate dissemination of the technology to a wide scientific community which can promote scaling. Besides, the USAID Mali Livestock Technology Scaling Program is also providing a platform for scaling of the improved feed troughs. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| This activity is linked to sub-activity on dual purpose sorghum varieties as the improved feed troughs will be used to feed the residues from the sorghum varieties at the Technology Park in M’Pessoba. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | |
| * Published article | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed is improved food security for the smallholder crop and livestock farmers as improved feed troughs will enhance feed use efficiency thereby increasing livestock productivity and consequently food security of the farmers. Less feed waste can also contribute to a profitable livestock enterprise thereby improving household income. | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The smallholder crop and livestock farmers, extension agents and scientific community. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | |
| Outcome/Output/  Activity | | | | | Sub-activity | | | **Budget line item** | | | | **ILRI** | |  |  |
| Outcome 1/Output 1/ Activity 2 | | | | | MA1121-20 | | | Personnel | | | | 28,510 | |  |  |
| Services | | | | 5,500 | |  |  |
| Supplies | | | | 2,500 | |  |  |
| Capital | | | | 0 | |  |  |
| Travel | | | | 3,000 | |  |  |
| Sub-total | | | | 39,510 | |  |  |
| Overhead (ILRI 15%) | | | | 5,927 | |  |  |
| Overhead (ICRISAT 17%) | | | | 7,724 | |  |  |
|  | | | | |  | | | **Total** | | | | **53,161** | |  |  |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Drafting of manuscript and submission to a journal. |  |  |  |  |  |  |  |  |  |  |
| Revision of manuscript based on reviewers’ comments. |  |  |  |  |  |  |  |  |  |  |
| Publication in a journal. |  |  |  |  |  |  |  |  |  |  |
| Finalization of the West Africa Handbook in collaboration with the co-authors as a team |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1122-20** | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | |
| a. Output 1.1 | Research products for more productive, intensive, diverse, profitable and resilient crop (cereals, legumes, and vegetables); livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | |
| b. Activity 1.1.2 | Test and disseminate a combination of improved breeds, housing, feeding, health and breeding practices to intensify rearing of livestock (sheep, goat, pig, and poultry) for meat, egg and milk production. | | | | | | | | | | |
| c. Sub-activity MA1122-20 | Demonstrate and promote fodder production for improved ruminant productivity. | | | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | Institution | | Role | | | | | | | | |
| Augustine Ayantunde | ILRI | | Coordination of sub-activity, design of the study, data analysis and final report | | | | | | | | |
| Theophile Dembele | AMEDD | | Coordinate establishment of the fodder demonstration plot at the Technology Park, training of farmers, data collection and report of the training | | | | | | | | |
| Bougouna Sogoba | AMEDD | | Organization of Farmers Field Day | | | | | | | | |
| Oumar Samake | AMEDD | | Supervise AMEDD activities | | | | | | | | |
| Benedict Boyubie | IITA | | Monitoring and evaluation/data management | | | | | | | | |
|  | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | |
| Name | Institute | Degree | | | | Start | | | End | | |
|  |  |  | | | |  | | |  | | |
|  | | | | | | | | | | | |
| f. Location(s) | Technology Parks in Koutiala and Bougouni districts | | | | | | | | | | |
|  | | | | | | | | | | | |
| g. Start | September 2019 | | | | | | | | | | |
|  | | | | | | | | | | | |
| h. End | April 2021 | | | | | | | | | | |
|  | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | |
| Feed scarcity is one of the major constraints to ruminant production in Mali. There is great potential to bridge feed gap in smallholder mixed crop and livestock systems through the introduction of forage species in southern Mali given the annual rainfall of about 900 mm spread over 5 to 6 months. Under the USAID Mali Livestock Technology Scaling Program, there has been a demonstration of the potential of a few forage species as livestock feed, for example, *Brachiaria ruziziensis,* and the results look promising from the biomass produced. However, adoption has been limited. To promote adoption of the forage species, the establishment of demonstration plots at the Technology Park will expose many farmers to this technology and will provide an opportunity for learning on how to plant the fodder species. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | |
| 2.1 The objectives of this sub-activity are: (i) To demonstrate the potential of forage species in bridging feed gap in smallholder mixed crop and livestock systems in southern Mali. (ii) To promote the adoption of forage species for improved ruminant productivity. (ii) To build capacity of farmers in forage production. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | |
| 3.1 What is the agronomic performance, particularly fodder biomass of the introduced forage species? | | | | | | | | | | | |
| 3.2 How can the Technology Park facilitate the adoption of the forage species? | | | | | | | | | | | |
| 3.3. How much fodder and over what area of production is regarded as sufficient for small ruminants during the dry season? | | | | | | | | | | | |
| 3.4. How many additional days of feed, how much saved labor, and reduced risks does the fodder production offer to smallholder farmers? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.). | | | | | | | | | | | |
| Fodder species namely *Brachiaria ruziziensis, Lablab purpureus* and *Sorghum almum* will be planted in the Technology Park in one community per region to demonstrate the potential of fodder production for improved ruminant production and to build the capacity of the farmers. A plot each measuring 50m2 (10m x 5m) will be established at the Technology Park in Koutiala and Bougouni for each fodder species. Agronomic data such as germination rate, plant height, leaf area index, and total biomass will be collected. Farmers will also be trained on how to plant the fodder species. The demonstration plots will be shown to farmers during the annual Africa RISING project farmers’ field day to promote adoption of the forage species by farmers. Farmers’ feedback on the performance of different forage species and the willingness of the farmer to grow Brachiaria in their farm in the next season will be collected. Training will be conducted for farmers on fodder production. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | Responsibility/Institute | | | | |
| Is the collected data part of a multi-year experiment/trial? No | | | | | | |  | | | | |
| 5.1. Germination rate, fodder biomass, plant height, leaf area index | | | | | | | ILRI and AMEDD | | | | |
|  | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | |
| Deliverables | | Means of verification | | | | | | Delivery date | | | |
| 6.1 Report of fodder production at the Technology Park | | Report by ILRI published on CG Space | | | | | | Apr. 2021 | | | |
| 6.2 A report on farmers field day | | Farmers Field Day Report uploaded on CGSPACE | | | | | | Oct./Nov. 2020 | | | |
| 6.3 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | Handbook revisions | | | | | | Oct. 2020 | | | |
|  | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | |
| Domain | Indicator | Metrics/  Scale | | | Approach used | | Before intervention | | | After intervention | |
| 7.1 Productivity | Biomass Productivity  Forage quality | Forage production (kg DM/ha/season) at plot level  Nitrogen and fiber content of fodder, and digestibility (g/kg DM) | | | Experimentation | |  | | |  | |
| 7.2 Environmental | Water availability | % of plants wilting | | | Experimentation | |  | | |  | |
| 7.3 Economic | Profitability  Labor requirement | Gross margin (cost and benefit of fodder produced)  Time required to establish the improved fodder plot (hour per ha) | | | Survey | |  | | |  | |
| 7.4 Social | Gender equity  Social cohesion | Rating of technology by gender  Participation in Community activities (as a result of saved time or more time needed to fetch forages) | | | Survey | |  | | |  | |
| 7.5 Human | Capacity to experiment | % Farmers adopting improved fodder  Modification made by the farmers | | | Survey | |  | | |  | |
|  | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | |
| The Technology Park will be used as a platform for scaling of the forage species. The annual field day will also provide an opportunity for farmers to learn about forage production will also be used to promote the dissemination of the technology. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | |
| This sub-activity is linked to sub-activity MA4411-20 on Technology Park as the fodder demonstration plots will be established at the Park in both Koutiala and Bougouni district | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | |
| * Number of visitors to the Technology Park * Report on the fodder production | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed is improved food security for the smallholder crop and livestock farmers. Improving fodder production will enhance livestock productivity thereby food security of the farmers. | | | | | | | | | | | |
| 11.2. Who is your target audience, e.g. extension agents, farmers, or policymakers?  The target audience includes farmers, extension agents and NGOs working on livestock issues. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 12. Budget (US$) (Carry over from previous year) | | | | | | | | | | | |
| Outcome/Output/  Activity | | | Sub-activity | **Budget line item** | | | | **ILRI** | | |  |
| Outcome 1/Output 1/  Activity 2 | | | MA1122-20 | Personnel | | | | 0 | | |
| Services | | | | 0 | | |
| Supplies | | | | 0 | | |
| Capital | | | | 0 | | |
| Travel | | | | 0 | | |
| Sub-total | | | | 0 | | |
| Overhead (ILRI 15%) | | | | 0 | | |
| Overhead (ICRISAT 17%) | | | | 0 | | |
|  | | |  | **Total** | | | | 0 | | |

\*\*\* There was no budget assigned for 2020/2021 since the sub-activity was carried over from 2019/2020 and is in the process of finalizing the deliverables

1. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Establishment of fodder demonstration plot at the Technology Park M’Pessoba |  |  |  |  |  |  |  |  |  |  |
| Training of farmers in fodder production |  |  |  |  |  |  |  |  |  |  |
| Collection of agronomic data |  |  |  |  |  |  |  |  |  |  |
| Finalization of the West Africa Handbook in collaboration with the co-authors as a team |  |  |  |  |  |  |  |  |  |  |
| Preparation of technical reports |  |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1131-20** | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | |
| b. Activity 1.1.3 | | | | Test and disseminate integrated crop-livestock-soil systems to increase and sustain productivity and reduce risk. | | | | | | | | | | | |
| c. Sub-activity MA1131-20 | | | | Risk management and informed decision making towards sustainable intensification of crop-livestock systems. | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | Institution | | | | | Role | | | | | | | |
| Katrien Descheemaeker | | | Wageningen University | | | | | Activity leader, student supervisor | | | | | | | |
| Jeroen Groot | | | Wageningen University | | | | | Activity co-leader | | | | | | | |
| Ken Giller | | | Wageningen University | | | | | Student supervisor | | | | | | | |
| Birhanu Zemadim | | | ICRISAT | | | | | Activity coordination | | | | | | | |
| Benedict Boyubie | | | IITA | | | | | Monitoring and evaluation/data management | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | Institute | | | | | Degree | | | | Start | | | End | |
| Arouna Dissa | | Wageningen University | | | | | PhD | | | | Jan. 2017 | | | Dec. 2020 | |
| Eva Huet | | Wageningen University | | | | | PhD | | | | Jan. 2017 | | | Dec. 2020 | |
| Sedou Maiga | | IPR/IFRA Bamako, Mali | | | | | MSc | | | | Jun. 2019 | | | May 2020 | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | | Koutiala, Mali | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | June 2018 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| Different crop-livestock intensification options and technologies have been tested in the Africa RISING project and other related research for development projects in the region. Notable examples of such options include soil fertility management technologies (such as mineral fertilizer, organic manure, including leguminous crops), fodder production, treatment and storage options, and manure and compost management, stall feeding of cattle, small ruminant fattening. Adoption of these options by farmers depends not only on their performance in terms of improving productivity but also on their effects on indicators in a range of sustainable intensification domains. Usually, these effects are evaluated for current farms in current conditions. However, because of many biophysical and socio-economic drivers, farming systems are rapidly changing. As sustainable development should also consider long-term effects, there is a need to assess the multi-criteria effects also on future systems. Scenario analysis provides a basis to conduct such analyses. To translate this academic exercise to actionable information for different types of stakeholders, visioning exercises with local stakeholders are powerful ways for contextualization. A shared vision for the future Malian farming systems could serve as a target for SI pathways, which lay out the steps and required enabling conditions to reach the vision.  Farming in southern Mali is conducted in a risky environment, related for instance to market and weather shocks and uncertainties. Crop-livestock interventions are usually not attractive to farmers if they increase farming risk. In order to tailor the interventions to the risky smallholder context, we need a better understanding of farmers’ risk mitigation strategies, and how the intended interventions aggravate or mitigate risks. As risk affects different farm components and farm activities and as different household members perceive and manage risk differently, a whole-farm and gender-disaggregated analysis is needed. With crop and livestock experiments typically spanning only a few years and a limited range of bio-physical conditions, dynamic models are promising tools to evaluate multi-year variability and to quantify risk and effects of risk mitigation options.  Another major bottleneck for the adoption of SI options is farmers’ limited planning and budgeting capacity for whole-farm management. Farmers need to balance (sometimes competing) objectives of food production and income generation under resource constraints related to capital, labor and land. Simple tools for record-keeping, for making objectives explicit and for budgeting farm activities, could assist farmers in taking the right strategic and tactical decisions for managing their farm. Incorporating the effects of promising crop-livestock intensification options in the decision-support tools mentioned above could help farmers to ex-ante assess the added value of their implementation. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 To explore the future impacts of sustainable intensification pathways in different SI domains (productivity, economic, environmental, human well-being) through scenario analysis and discuss these with local stakeholders | | | | | | | | | | | | | | | |
| 2.2 To assess the potential of SI interventions in terms of risk mitigation in relation to for example weather and market shocks and uncertainty | | | | | | | | | | | | | | | |
| 2.3 To report on the development and use of a decision support tool for farm planning and budgeting with farmers in southern Mali | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 Which agricultural and policy interventions can improve performance in the productivity, economic, environmental and food security domains of SI; and mitigate trade-offs between the domains for different types of farmers? | | | | | | | | | | | | | | | |
| 3.2 What is the potential of SI interventions for cushioning different types of farmers against common risks related to weather, labor and market shocks and uncertainties? | | | | | | | | | | | | | | | |
| 3.3 How can farmers in southern Mali be supported in terms of farm planning and budgeting, and how does that influence their decisions to implement SI options? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| 4.1. In Falconnier *et al*. (2018)[[58]](#footnote-58) we conducted a scenario analysis to explore the effects of future development pathways on food self-sufficiency and farm income. The current situation was compared against 5 contrasting future scenarios combining policy and agricultural interventions for all 99 households of a village in southern Mali. The current situation was described based on household survey data from 2013. From that baseline, we looked 15 years ahead to describe plausible contrasting mid-term futures. In this activity, we are extending this scenario analysis with additional indicators in the productivity, environmental, economic and human well-being domain of SI. A first step was made by Hambuechen (2019)[[59]](#footnote-59) to include nutritional, soil fertility, income and labour productivity indicators. We are now taking this one step further by including greenhouse gas emissions, leaching and a more detailed analysis of year-to-year variability in the indicators. This work uses existing household datasets, crop model output, and the model described in Falconnier *et al*. (2018). The above described scenario analysis will be complemented with participatory visioning exercises with local stakeholders, including farmers and higher-level decision makers. A first visioning workshop was conducted in March 2020. A second workshop in the first half of 2021 will build on that and use the output of the scenario analysis in discussions with stakeholders. | | | | | | | | | | | | | | | |
| 4.2 Based on data from focus group discussions (FGDs) (n=8) and surveys (n=250), we described the risk perceptions and risk mitigation strategies by different farm types. For the risks that were perceived most important (i.e. weather and labour-related risks), a dynamic model analysis is conducted to explore the effects of risk mitigation strategies and the effects of specific crop-livestock interventions on risk and farm production stability. The DSSAT crop growth model is used and outputs will be integrated into a whole-farm analysis, based on existing detailed farm characterizations. Calibration of the model is done using previously defined (by project partners) parameters for crop varieties, soil and weather conditions relevant for the Koutiala region (e.g. Adam *et al*., 2018)[[60]](#footnote-60). Model setup has been completed and in the coming months, the model will be run and the simulation output will be used to finalize the analysis.  Farmers already participated in FGDs and surveys in 2017 and 2018 discussing their perception of risks and the strategies they apply. In the modeling exercise, the effects of these risks will be quantified. We planned a new round of FGDs (n=4) in 2020 in the four target villages, which will be postponed until the COVID-19 crisis allows travelling of PhD student Eva Huet. The results of the model analysis will be discussed with farmers who participated in the risk surveys in 2018. Their risk perception and strategies will be either challenged or confirmed. The FGD will feed information back to farmers but will also contribute to the scientific discussion by learning from farmers’ feedback. | | | | | | | | | | | | | | | |
| 4.3 Two types of tools have been developed in previous years, namely a detailed, research-oriented tool and a “simple”, farmer-oriented tool for record-keeping, farm planning and budgeting, and evaluation. These tools have been used with 22 farmers in 2019. The data collected with the research-oriented tool will now be used for a detailed analysis of farmers’ decision making and how this is influenced through using the tool. This analysis will focus on farm-level indicators in the economic and food security domains of SI. An increased number of farmers (n=36) in the target villages will get the opportunity to get acquainted with the farmer-oriented tool under guidance of a trained technician. Besides that, guidelines on the farmer-oriented tool will be developed for use by local extension agents and development actors, which will enable further scaling of the tool. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | Responsibility | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | |  | | | | | |
| 5.1 Results from the scenario analysis and visioning exercise | | | | | | | | | | WUR | | | | | |
| 5.2 Results from the risk modelling analysis | | | | | | | | | | WUR | | | | | |
| 5.3 Farm records and data on farm planning | | | | | | | | | | WUR | | | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | | | Delivery date | | |
| 6.1 Conference presentation on scenario analysis | | | | | | Book of Abstracts of Food security conference | | | | | | | December 2020 (current date of the conference; depending on COVID-19 restrictions) | | |
| 6.2 Draft paper on risk modelling analysis | | | | | | Draft paper shared with ICRISAT and the chief scientist | | | | | | | Dec. 2020 | | |
| 6.3 Draft paper on farm planning and budgeting tool | | | | | | Draft paper shared with ICRISAT and the chief scientist | | | | | | | May 2021 | | |
| 6.4 Guidelines for the use of the decision support tools | | | | | | The guidelines will be made available and shared | | | | | | | May 2021 | | |
| 6.5 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | Handbook revisions | | | | | | | Oct. 2020 | | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | |
| Domain | Indicator | | | | Metrics/Scale | | | | Approach used | | | Before intervention | | | After intervention |
| 7.1 Productivity | Crop Productivity  Animal productivity | | | | Crop yield (Kg/ha) at farm level  Farm level milk production (Kg milk/farm/year) and animal production (animals/farm/year) | | | | Field data | | |  | | |  |
| 7.2 Environmental | Nutrient partial balance | | | | Nitrogen balance (Kg N/ha); Nitrogen use efficiency (Kg DM/kg N) | | | | Field data | | |  | | |  |
| 7.3 Economic | Risk  Income variability  Profit variability | | | | Frequency and impact of hazard occurrences, variability in farm profitability, enterprise budgets for livestock and crops ($/farm), agricultural profit ($/ha, $/farm), living income ($/capita/year), probability that profits are less than thresholds related to poverty and living income (%), labor productivity ($/man-day) | | | | Survey | | |  | | |  |
| 7.5 Human | Nutrition | | | | Food self-sufficiency (in calories, protein, micronutrients; % of requirements) | | | | Survey | | |  | | |  |
|  | | | | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- |
| 8. How will scaling be achieved? | | | | | |
| Quantified effects of crop-livestock intensification options on economic indicators and risk will allow a better understanding of important constraints and bottlenecks to adoption by farmers. By involving higher-level decision-makers in the visioning workshop and discussions of the scenario analysis, their awareness will improve and they may be more prepared to take into account farmer constraints when prioritizing interventions for more widespread uptake. A disaggregated analysis, enabled by information gathered from different types of farmers and gender groups through the household surveys, will inform more effective tailoring of options.  The planning and budget tool will inform farmers about the potential effects and needed resources of SI options and practices, thus influencing famers’ decisions on the use of these options and practices. The scaling of the tool will be enabled by the development of tool guidelines for use by extension agents and development practitioners. The tools and the guidelines will be actively shared in wider networks and through other projects. | | | | | |
|  | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | |
| Firstly, the activity can be linked to the sub-activity MA1113-20 which is using DSSAT model parametrization and outputs can be exchanged with researchers working in MA1113-20.  Secondly, the activity is in line with the USAID work on quantifying risk and resilience. | | | | | |
|  | | | | | |
| 10. Custom indicators | | | | | |
| * 4 focus group discussions on risk topics * 1 Tool for focus group discussions and scenario feedback workshop shared * 22 farmers trained on using the planning and budgeting tools | | | | | |
|  | | | | | |
| 11. Impact-based summary matrix | | | | | |
| 11.1 What is the development challenge you are addressing?  This activity attempts to close the gap between agricultural crop and livestock research and decisions making processes by farmers. It takes into account potential challenges and associated risks for farmers in the future through scenario analysis. | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?   * Farmers (budgeting tool and risk assessment) * Extension workers (budgeting tool) * Policymakers (risk quantification and scenario analysis on future developments) | | | | | |
|  | | | | | |
| 12. Budget (US$) | | | | | |
| Outcome/Output/Activity | Sub-activity | **Budget line item** | **WUR** |  |  |
| Outcome 1/Output 1/Activity 2 | MA1131-20 | Personnel | 16,440 |  |  |
| Services |  |  |  |
| Supplies |  |  |  |
| Capital |  |  |  |
| Travel | 4,000 |  |  |
| Sub-total | 20,440 |  |  |
| Overhead (WUR 16%) | 3,270 |  |  |
| Overhead (ICRISAT 17%) | 4,031 |  |  |
|  |  | **Total** | **27,741** |  |  |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | | **2020** | | | | | | | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** |
|  | Extension of the scenario analysis with additional indicators |  |  |  |  |  |  |  |  |  |  |  |  |
| Model simulation and data analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Stakeholder workshop |  |  |  |  |  |  |  |  |  |  |  |  |
| Conference presentation |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Analysis of weather patterns creating a hazard |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Representing risk management strategies in the model |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Simulation of SI options and risk management strategies |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Analysis of simulation output |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Drafting of paper on model analysis |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Feedback sessions with farmers |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Monitoring of on-farm activities |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Analysis of the detailed data collected |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Developing guidelines |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Drafting of paper on decision support tools |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1211-20** | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | |
| a. Output 1.2 | | | | | Integrated management technologies and practices to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated to farmers and development partners in the intervention communities. | | | | | | | | | | |
| b. Activity 1.2.1 | | | | | Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and eco-systems services at the farm and landscape/watershed levels. | | | | | | | | | | |
| c. Sub-activity MA1211-20 | | | | | Assess cropping management factors using empirical relations, GIS and Remote Sensing tools in two agro-ecologies of Mali. | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | | | | | | |
| Birhanu Zemadim | | | ICRISAT | | | | Leader, Land and Water Management | | | | | | | | |
| Abdramane Ba | | | USTTB | | | | PhD thesis advisor | | | | | | | | |
| Ramadjita Tabo | | | ICRISAT | | | | Review and guide the technical report | | | | | | | | |
| Souleymane Sanogo | | | USTTB | | | | PhD thesis co-advisor | | | | | | | | |
| Kalifa Traore | | | IER | | | | Contribute to technical report | | | | | | | | |
| Bougouna Sogoba | | | AMEDD | | | | Provide GIS and Remote Sensing data | | | | | | | | |
| Mahamadou Dicko | | | AMEDD | | | | Activity coordination in Koutiala and Bougouni | | | | | | | | |
| Benedict Boyubie | | | IITA | | | | Monitoring and evaluation/data management | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | | Institute | | | | Degree | | | Start | | | End | |
| Karamoko Sanogo | | | | USTTB | | | | PhD | | | Jan. 2017 | | | Mar. 2021 | |
|  | | | |  | | | |  | | |  | | |  | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | | Koutiala and Bougouni | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | September 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| The semi-arid region of Mali is characterized by intensive agricultural practices, land degradation and very strong climatic variability. Soil water erosion consists of a major problem for agricultural productivity and monitoring erosion or soil loss becomes trivial when it’s done at an individual and separate or non-connected farmland area as the whole landscape is prone to heavy erosion during storm events. Excessive and uncontrolled erosion is the main cause to a loss of inherent soil fertility levels of N, P, K, and thus to a decline in potential crop yield at plot or farm levels (Mahdi *et al*., 2002)[[61]](#footnote-61). Up until recently in most parts of southern Mali sustainable land management practices focused on reducing runoff and soil loss from plot or farm level through implementation of soil and water conservation (SWC) practices such as contour bunding. Though important in its application at plot or farm level, efficiency of contour bunding is limited to address landscape vulnerability of degradation and loss of crop productivity. Excessive soil water erosion is caused by an accumulated runoff from farm fields, grazing areas or from bushland or a combination of many land uses and land covers. Landscape-level information on the processes of soil water erosion and water infiltration and the associated losses of plant-available nutrients are often missing in most studies. In this study determination of crop management factors that are functions of soil water loss at a landscape level are conducted. The study includes identification and mapping of erosion factors at landscape levels and aims to build model parameters by estimating rainfall erosivity factor, soil erodibility factor, and topographic factors responsible for runoff generation in the watershed villages of Bougouni and Koutiala through empirical relations, GIS and Remote sensing techniques. The study will be useful in providing guided information on the importance of controlling soil erosion at a landscape level and predict spatial distribution of plant nutrients suitable to increase crop productivity. To preserve soil and water resources, decision-makers need information on natural resources to plan suitable strategies and measures. Mapping soil erosion risk identifies vulnerable areas for environmental protection. In addition, the economic value of soil erosion can be used by the decision-makers to prioritize areas of soil conservation and integrated watershed management practices[[62]](#footnote-62). Most of the data have been collected and data is being analyzed. The main activity for 2020/2021 will be writing a manuscript that uses data collected in 2019/2020 with a supplementary data collected in Africa RISING project since 2015. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 Determine landscape level mean annual soil loss using empirical relations, GIS and Remote sensing techniques | | | | | | | | | | | | | | | |
| * Assess the impact of soil erosion on landscape soils productivity. | | | | | | | | | | | | | | | |
| * Evaluate variations of plant-available nutrients, such as carbon, nitrogen, phosphorous, and potassium in different agro-ecologies under different land use systems. | | | | | | | | | | | | | | | |
| * Identify areas affected by natural and anthropogenic changes. | | | | | | | | | | | | | | | |
| * Provide appropriate guidance and recommendation on environmental protection to help increase crop productivity and reduce soil degradation. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| * 1. What is the spatial distribution of soil loss rate in southern Mali? | | | | | | | | | | | | | | | |
| * 1. To what extent does soil water erosion affects smallholder rural agriculture yield? | | | | | | | | | | | | | | | |
| * 1. How important are efficient landscape erosion controlling measures advantageous from the ecologic and social perspectives to increase productivity and reduce poverty? | | | | | | | | | | | | | | | |
| * 1. What are the most vulnerable areas in the two agro-ecological zones (Sudan Savanna and Guinea Savanna)? | | | | | | | | | | | | | | | |
| * 1. How do the interventions increase resilience of communities? E.g. if intervention X is conducted, it results in Y drought-free days which equates to building resilience. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, sample size, etc.) | | | | | | | | | | | | | | | |
| 4.1 This work involves the use of soil moisture data collected in phase 1 of Africa RISING project (soil moisture data is available from 2014 to 2017) to investigate the influence of erosion on soil water infiltration. Remotely sensed soil moisture data will be correlated with the ground data to provide information on landscape soil moisture information. Long term data on rainfall amount and intensity will be used to estimate rainfall erosivity factor. The topographic map and Digital Elevation Map from high-resolution satellite imagery will be used to determine the soils topographic factor and soil erodibility factor. Here the GIS version of modified universal soil loss equation will be used to estimate soils topographic factors. Mapping of cropping management factors will be made at a landscape scale in the two agro-ecologies. Product maps will be produced to identify vulnerable areas at landscape level and will be communicated to land planners and national research institutes. The main activity of the work plan in 2020/2021 is finalizing the data analysis and prepare a manuscript for publication. | | | | | | | | | | | | | | | |
| 4.2 A survey will be conducted to complete the study based on which conclusions and recommendations will be made for best management practices. The survey will investigate farmers’ perception of the influence of soils, water erosions on smallholder income and the contribution of erosion to poverty and outward migration. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | Responsibility/Institute | | | | | | |
| Is the data collected part of a multi-year experiment? Yes | | | | | | | | | ICRISAT | | | | | | |
| No new data is collected but will ensure that all previously collected data is uploaded on dataverse | | | | | | | | | ICRISAT | | | | | | |
|  | | | | | | | | |  | | | | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | Means of verification | | | | | Delivery date | | |
| * 1. Report on vulnerability of landscape pattern from multidisciplinary approach based on remote sensing (RS) and geographical information system (GIS) determined. | | | | | | | | Report uploaded on CG Space | | | | | Feb. 2021 | | |
| * 1. Report on Household perception on land management strategies for reducing soil erosion and soil fertility improvement. | | | | | | | | Report uploaded on CG Space | | | | | Feb. 2021 | | |
| * 1. Publication based on both reports | | | | | | | | Manuscript submitted to Journal of Agriculture and Food Security. | | | | | Jun. 2021 | | |
| * 1. Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | | | Handbook revisions | | | | | Oct. 2020 | | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | |
| Domain | Indicator | | | | | Metrics/scale | | | | Approach used | | Before intervention | | | After intervention |
| 7.2 Environmental | Vegetative Cover  Erosion | | | | | % vegetative and tree cover (end of wet season, end of dry season)  Erosion (t/ha/yr) (MUSLE or RUSLE) | | | | GIS and Remote Sensing  Information | |  | | |  |
| 7.4 Social | Equity (Gender, Marginalized group)  Level of social cohesion | | | | | Variability and distributions of productivity, income and assets  Active farmer groups  Active innovation platforms | | | | Survey | |  | | |  |
|  | | | | | | | | | | | | | | | |

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| 8. How will scaling be achieved? |
| Scaling is achieved through promoting the landscape maps on soil loss and providing a guidance on appropriate land management practices at landscape levels. Scaling is done by project partners and others in Mali who are interested in landscape management practices like CARE-Mali, WFP and UNDP. Local NGOs will be used to train the farming communities in local languages on appropriate practices to reduce land degradation. The information generated from the different agro-ecologies on the benefits of reducing soil-water losses at the landscape levels will be communicated widely. |
|  |
| 9. How are the activities in this protocol linked to those of others? |
| This activity is linked to most agronomic, soil fertility improvements and soil and water conservation practices proposed in the sub activities of the work plan. |
|  |
| 10. Custom indicators |
| * Percentage of land area prone to erosion * Percentage gains in productivity by applying SWC practices at landscape levels * Resilience metrics as a result of SWC interventions * Number and types of technologies implemented |
|  |
| 11. Impact-based summary matrix |
| 11.1 What is the development challenge you are addressing?  Most of the farmlands in rural Mali are prone to erosion due to excessive rainfall within short duration. The extent of runoff generated hasn’t been studied well at a landscape level even though well-documented information at the farm level exists widely. By determining cropping management factors areas suitable for agricultural production will be studied and communicated. Degraded and erosion hotspot areas will be mapped for proper attention by the decision-makers. |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers in rural communities are the target groups. In addition, policymakers, land managers are the target groups. |
|  |
| 1. Budget (US$) |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Outcome/Output/  Activity | Sub-activity | **Budget line item** | **ICRISAT** |  |  |
| Outcome 1/Output 2/Activity 1 | MA1211-20 | Personnel | 28,000 |  |  |
| Services | 3,500 |  |  |
| Supplies | 2,500 |  |  |
| Capital |  |  |  |
| Travel | 2,500 |  |  |
| Overhead (17%) | 6,205 |  |  |
| **Total** | **42,705** |  |  |

1. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | | **Jun** |
| Finalization of the West Africa Handbook in collaboration with the co-authors as a team. |  |  |  |  |  |  |  |  |  |  |  |  | |
| Analysis of long-term data and archiving land use, land cover and soil information. |  |  |  |  |  |  |  |  |  |  |  |  | |
| Determination parameters for soil erodibility and erosivity. |  |  |  |  |  |  |  |  |  |  |  |  | |
| Classified assessment of landscape analysis. |  |  |  |  |  |  |  |  |  |  |  |  | |
| Scientific article writing and submission. |  |  |  |  |  |  |  |  |  |  |  |  | |

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| **Planned work** | | | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol–Outcome 1: MA1212-20** | | | | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | | | | |
| a. Output 1.1 | | | Research products for more productive, intensive, diverse, profitable and resilient crops (cereals, legumes, vegetables), livestock (sheep, goats, cattle, poultry and pigs) and integrated crop-livestock farming systems are identified and disseminated to farmers through development partners in the intervention communities. | | | | | | | | | | | | | | | |
| b. Activity 1.2.1 | | | Test and disseminate land, soil and integrated land-soil technologies and practices to improve and sustain productivity and eco-systems services at the farm and landscape/watershed levels. | | | | | | | | | | | | | | | |
| c. Sub-activity MA1212-20 | | | Improving crop-livestock productivity and household income through the use of contour bunding and agroforestry options. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | | | |
| Name | Institution | | | | | Role | | | | | | | | | | | | |
| Kalifa Traore | IER | | | | | Activity leader, protocol design, statistical analysis, reporting, supervision of ongoing PhD student | | | | | | | | | | | | |
| Oumar Samake | IER | | | | | Research assistant, implementation, data collection | | | | | | | | | | | | |
| Fotigui Cissé | IER | | | | | Research assistant, social data collection and support of trials implementation | | | | | | | | | | | | |
| Benedict Boyubie | IITA | | | | | Monitoring and evaluation/data management | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | | | |
| Name | | | | | Institute | | | Degree | | Start | | | | | End | | | |
| Cheick Oumar Dembele | | | | | USTTB | | | PhD | | Jan. 2017 | | | | | Mar. 2021 | | | |
|  | | | | | | | | | | | | | | | | | | |
| f. Location(s) | | District of Koutiala | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| g. Start | | March 2017 | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| h. End | | April 2021 | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | | | |
| Key elements to ensure sustainability of agriculture-livestock systems are adequate production of quality forage for animal supplementation but also availability of water and soil nutrients. Among these, quality forages, fast-growing nitrogen-fixing tree species and herbaceous plants occupy a prominent place. According to Breman and Kessler (1995)[[63]](#footnote-63), the power to concentrate and save nutrients, produce and maintain high biomass quantity exceeds far that of cereals and other grass species. All the fast-growing nitrogen-fixing trees (FGNFT) are not acceptable to livestock because of nitrogen content and availability.  A study on fodder yield and nutritive value of many tree species in West African humid areas showed that *Gliricidia sepium* and *Leucaena leucocephala*, were identified to have high potential for the development of integrated crop-livestock agroforestry technologies because of fodder yield, concentrations of CP, NDF, ADF and lignin (Larbi et al., 2005)[[64]](#footnote-64). Larbi et al. (2005)reported that coppicing regrowth of these species could be harvested between 16 and 20 weeks to maximize the yield and quality of the fodder. In Western Kenya, a biomass yield of 21 t/ha was observed with *Sesbania sesban* on many nutrient-depleted soils (Sjogren et al., 2010)[[65]](#footnote-65). It is against this background that we proposed to study possibilities of introducing fast-growing forage tree species in farmers’ fields under Contour Bunding (CB) techniques. Traore et al. (2017a)[[66]](#footnote-66) reported that water storage was always higher in CB plots compared to control plots with a surplus of 0.23 mm/day in 2012 and 0.43-mm/day in 2013 in the CB plots over the monitoring period in the Cinzana Sahelian area of Mali. Also, millet grain yield in 2012, 2013, and 2014 was statistically higher in CB plots compared to the control with yield difference ranging from 301 Kg/ha in 2012 to 622 Kg/ha in 2013. These values corresponded to an increase of 60 and 56%, respectively. Concerning sorghum grain yield, it increased consistently from 461 Kg/ha in 2012 to 1378 Kg/ha in 2014. Moreover, the qualitative assessment done by farmers on the effects of CB revealed that rainwater was kept between contour ridges reducing runoff and consequently increasing infiltration and crop yields (grain and straw) in contoured plots. Also, with the use of CB, soil moisture was found to be better conserved and allowed field operations for an additional 7 to 10 days (Traore et al., 2017b)[[67]](#footnote-67). Intercropping could also benefit from this technology and the ongoing PhD work showed a net benefit through the increase of the land equivalent ratio (LER) and the value to cost ratio (VCR), mainly when associated with micro-dosing of nutrients. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 1. Objectives | | | | | | | | | | | | | | | | | | |
| * 1. Assess the role of CB towards increasing household resilience against drought | | | | | | | | | | | | | | | | | | |
| * 1. Evaluate crops and fodder plants growth and yields under CB technology | | | | | | | | | | | | | | | | | | |
| * 1. Evaluate the effect of micro-dosing and intercropping system on crops yield | | | | | | | | | | | | | | | | | | |
| 2.4 Develop a business model on nurseries that engage the youth and women farmers | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 1. Research questions | | | | | | | | | | | | | | | | | | |
| * 1. What are the impacts of CB on improving household resilience? | | | | | | | | | | | | | | | | | | |
| * 1. What is the impact of CB on fodder tree production? | | | | | | | | | | | | | | | | | | |
| * 1. Does micro-dosing and intercropping improve crop yields and farmers’ income in comparison with the recommended technique when combined with CB technology? | | | | | | | | | | | | | | | | | | |
| 3.4 How does the business model on nurseries look like and can it be scalable? | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 1. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | | | |
| Two types of experiments are proposed: Activities presented in sections 4.1 and 4.2 started in the year 2019/2020, and the second-year data is required to complete the experiment and produce a publication. Activity 4.3 is focusing on manuscript production.  4.1. Agronomic Operations.  A trial with a factorial combination of two tillage practices (Contour bunding (CB) technology and no contour bunding (NCB) or farmer’s practices) with four types of soil fertilization, (i) no amendment, (ii) organic manure OM (5t/ha), (iii) micro-dose OM (2.5t/ha) + Complex cotton CC (100 Kg/ha) + Urea (25 Kg/ha), (iv) recommended dose = OM (5t/ha) + Complex cotton CC (200 Kg/ha) + Urea (50 Kg/ha) will be implemented. The trial will be done in split-plot design with four replications; tillage practices represent the main plots with the soil amendments as sub-plots. The dimensions of the sub-plots are 4m x 3m. The main plots are 1m apart using cotton (Gossypium sp.) variety N’TA 93-15 as test crop. The same trial will be conducted on six different farms.  Completion of the data on cropping system (soybean intercropped with sorghum) will be performed. This trial, is the second experiment with a factorial combination of two tillage practices (CB and NCB) and three cropping variables: (i) sorghum sole crop, (ii) intercropping sorghum-soybean, (iii) soybean sole crop will be implemented. The trial is in split-plot design with four replications. Tillage practices represent the main plots with the crops as sub-plots. The dimensions of the sub-plots are 10m x 5m. The main plots are separated by 1m. A local sorghum (*Sorghum bicolor* L. Moench), variety – named “Begnebling” in Kani and “Bentoroko” in M’Pessoba – which has a growth duration of 90-100 days and soybean (*Glycine max* (L.) Merr.) variety G115 which has a growth duration of 110 days are used as test crops. The trial will be conducted on nine different farms and in one technology park. Amendments used in intercropping are: (i) Sorghum: OM (2.5t/ha) + Complex cereal CC (50 Kg/ha) + Urea (25 Kg/ha), Soybean: OM (2.5t/ha) + DAP (50 Kg/ha). | | | | | | | | | | | | | | | | | | |
| * 1. Tree Systems Operations   Completion of data collection on trees will be done. Data will be collected from farm fields of the forty collaborative farmers chosen in the year 2019. Soil sampling will be conducted using an auger at 0-20 cm and 20-40 cm depth and samples sent for physicochemical analysis in the Soil-Water-Plant Laboratory of IER. The field of each farmer will be divided into two parts. The first part is under contour bunding (CB) i.e. ridges follow contour lines and the second one with farmer’s practices labelled as non-contour bunding (NCB) implemented as a control. The contour lines will be planted with fast-growing tree species chosen by farmers, such as *Gliricidia sepium* and *Leucaena leucocephala*. Trees will be planted on the crest of the contour bund which will be 0.8 m wide and 100 m long. The work involves the implementation of nurseries for the production of seedlings of fast-growing tree species.  Establishment of tree nurseries: Nurseries of fast-growing trees species will be established with village youth and volunteer women farmers. The type and modality of established nurseries will be assessed regarding economic and social assessments of SIAF. The modality of scaling out nurseries to other locations will be formulated.  Data analysis: Data will be analyzed using STATBOX 7. Analysis of variance will be used to assess the performance of treatments and means comparison by LSD procedure. | | | | | | | | | | | | | | | | | | |
| * 1. Manuscript publication   Biophysical data has been collected from the different agro-ecologies under different treatment conditions of the farming system. It is time now to consolidate the output of the multi-year operation by publishing the output in a reputable journal. An article that combines the effect of CB on the performance of intercropping system, ecological sustainability of the farming system improvements in soil fertility will be prepared. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | Responsibility/Institute | | | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | |  | | | | | | | |
| * 1. Biophysical data: height, basal diameter, crown radius and diameter at 1.3 m height when possible will be performed on fast-growing tree species starting at their planting date | | | | | | | | | | | IER | | | | | | | |
| * 1. Cultural operations: plowing or ridging date, planting date, emergence date, thinning date, planting density, plant density at harvest, plant height, grain yield, straw yield, thousand-grain yield | | | | | | | | | | | IER | | | | | | | |
| * 1. Soil physical and chemical properties | | | | | | | | | | | IER | | | | | | | |
| * 1. Crop yield (straw and grain) | | | | | | | | | | | IER | | | | | | | |
| * 1. Economic and social data on farmers’ engagement in tree nurseries | | | | | | | | | | | IER | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | | Delivery date | | | | | | |
| * 1. Data on agronomic and tree growth | | | | | | Data uploaded on Dataverse | | | | | | May 2021 | | | | | | |
| * 1. PhD Thesis submitted by Mr. Cheick Oumar Dembele to Bamako University | | | | | | PDF copy of PhD thesis uploaded on CG Space | | | | | | Dec. 2020 | | | | | | |
| * 1. A manuscript on the effect of CB on the performance of intercropping system, ecological sustainability of the farming system improvements in soil fertility. | | | | | | Manuscript submitted to Sustainability journal | | | | | | May 2021 | | | | | | |
| * 1. Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | Handbook revisions | | | | | | Oct. 2020 | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | | | | |
| Domain | Indicator | | | | Metrics/Scale | | | | Approach used | | | | | Before intervention | | | After intervention | |
| 7.1 Productivity | Crop productivity  Input use efficiency  Cropping intensity | | | | Yield (kg/ha) at farm level  # of cropping seasons per year at farm level | | | | Experimentation | | | | |  | | |  | |
| 7.2 Environmental | Soil chemical properties, Soil fertility | | | | NPK, pH, OM at plot level | | | | Field and laboratory | | | | |  | | |  | |
| 7.3 Economic | Profitability, variability of profitability | | | | Farm-level cost-benefit analysis to determine the best fertilizer scenarios | | | | Survey | | | | |  | | |  | |
| 7.4 Social | Social cohesion  Gender Equity | | | | Participation in community activities at household level  Management control by gender; market participation by gender | | | | Survey | | | | |  | | |  | |
|  | | | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | | | |
| After training of selected youth farmers on nursery techniques, they will develop a business model to supply demanding farmers with fast-growing tree species. In September, when there is little fieldwork, a farmer exchange visit will be organized to show the growth and development of the different fast-growing tree species planted on the crest of the contour line. In addition, a training on the implementation of the contour bund technology will be done within the community that will involve trained and knowledgeable farmers who will in turn train other farmers. Alternatively, there may be an option where farmers pay directly about 10 USD to AMEDD for implementation of the contour bunds. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | | |
| This sub-activity is linked to sub activity MA1211-20 | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | | | |
| * Number of nurseries established * PhD thesis | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed is on how to integrate crop, livestock, and agroforestry to efficiently contribute to food security while adapting the production systems to climate change. | | | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers, Extension agents and NGOs. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | | | | |
| Outcome/Output/Activity | | | | Sub-activity | | | **Budget line item** | | | | | | **IER** | | |  | |  |
| Outcome 1/Output 2/  Activity 1 | | | | MA1212-20 | | | Personnel | | | | | | 16,849 | | |  | |  |
| Services | | | | | | 5,411 | | |  | |  |
| Supplies | | | | | | 3,425 | | |  | |  |
| Capital | | | | | |  | | |  | |  |
| Travel | | | | | | 5,462 | | |  | |  |
| Overhead (IER 10%) | | | | | | 3,114 | | |  | |  |
| Overhead (ICRISAT 17%) | | | | | | 5,824 | | |  | |  |
|  | | | |  | | | **Total** | | | | | | **40,085** | | |  | |  |

1. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | | **Jun** |
| Finalization of the West Africa Handbook in collaboration with the co-authors as a team. |  |  |  |  |  |  |  |  |  |  |  |  | |
| Farmers Training and protocol establishment |  |  |  |  |  |  |  |  |  |  |  |  | |
| Data collection and Analysis |  |  |  |  |  |  |  |  |  |  |  |  | |
| Finalization and submission of PhD Thesis to Bamako University |  |  |  |  |  |  |  |  |  |  |  |  | |
| Technical report writing and submission |  |  |  |  |  |  |  |  |  |  |  |  | |

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| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 1: MA1221-20** | | | | | | | | | | | | | | | |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets. | | | | | | | | | | | | | | | |
| a. Output 1.2 | | | | | Integrated management technologies and practices to improve and sustain productivity and ecosystems services of the soil, land, water and vegetation resources are developed and disseminated to farmers and development partners in the intervention communities. | | | | | | | | | | |
| b. Activity 1.2.2 | | | | | Test and promote water management technologies and practices to increase water productivity in the small-scale crop-livestock farming systems under rainfed and irrigated conditions. | | | | | | | | | | |
| c. Sub-activity MA1221-20 | | | | | Evaluate improved irrigation technologies for efficient and sustainable agricultural water management in rural Mali. | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | Institution | | | Role | | | | | | | | | |
| Birhanu Zemadim | | | ICRISAT | | | Activity leader, Land and Water Management Scientist | | | | | | | | | |
| Ramadjita Tabo | | | ICRISAT | | | Revising technical reports | | | | | | | | | |
| Felix Badolo | | | ICRISAT | | | Economic analysis | | | | | | | | | |
| Bougouna Sogoba | | | AMEDD | | | Farmers mobilization | | | | | | | | | |
| Benedict Boyubie | | | IITA | | | Monitoring and evaluation/data management | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | Institute | | | | Degree | | | Start | | | End | | |
| Karamoko Sanogo | | | USTTB | | | | PhD | | | Jan. 2017 | | | Mar. 2021 | | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | | Koutiala and Bougouni | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | September 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| In rainfed agricultural systems, sustainable and efficient water management practices are key to improved agricultural productivity and natural resources management. The agricultural productivity in sub-Saharan Africa (SSA) heavily relies on the availability of rainfall. With the erratic and unreliable rainfall pattern associated with poor and fragile soils, the crop and livestock productivity has remained very low over the years in most of SSA countries including Mali. Much of the SSA agricultural land has been degraded and is less fertile as a result of continuous years of cultivation and being prone to wind and water erosion. This results in an increased food shortage because the land has not been able to support the food demands of the ever-increasing population. Better agricultural and nutritional security are further hampered by the lack of reliable access to the available water resources in the subsurface.  The two main surface water sources in Mali are the basins of the Senegal River and the Niger River with a total capacity of 70 billion metric cube of water in an average year. The volume of static underground water reserve is estimated at 2700 billion metric cubes with an annual recharging rate of 66 billion metric cubes. The surface water contributes about 10 to 15% of the total volume of water consumed by populations, the balance of the demand is covered by underground water (DNH, 2016)[[68]](#footnote-68). Extraction and use of groundwater as a resource has been low mainly because in rural community settings large irrigation systems (through dams) are very expensive to implement (DNH, 2016)[[69]](#footnote-69). Small scale irrigation systems can be implemented at relatively low costs to benefit smallholder communities.  This work plan aims at improving agricultural productivity, nutritional security and household incomes through the use of solar energy pumps and improved irrigation technologies for efficient and sustainable agricultural water management in rural Mali. Similar to other SSA countries neither hydrocarbon energized motor pumps nor electrical pumps are affordable by the smallholder farmers in rural Mali. Introduction of solar energy-based irrigation pumps are ideal for increasing agricultural productivity and diversifying farming practices to produce high valued agricultural products like meat and vegetables. Solar panels are becoming more affordable and the improved solar photovoltaic (PV) technologies, with low carbon footprint have been identified as high potential solutions for rural electrification as well as water extraction for domestic, livestock and irrigation purposes in SSA. As such, solar PV pumps and improved irrigation technologies have become an emerging climate-smart technology in SSA for smallholder farmers (Schmitter *et al.*, 2018)[[70]](#footnote-70). To be highly productive the solar irrigation technologies need to be accompanied by improved agronomic management practices and soil moisture conservation techniques. Most of the data have been collected in 2019/2020 and is being analyzed. The activity for 2020/2021 will be the identification of practical solutions for agricultural water management investment for the smallholder farming communities. Additionally, a manuscript preparation and submission is the task for the reporting year. All data collected in 2019/2020 will be used to prepare the manuscript along with biophysical data sets collected in the Africa RISING project since 2015. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 Evaluate existing initiatives and constraints in using efficient and sustainable water management practices using solar energy pumps and improved irrigation technologies | | | | | | | | | | | | | | | |
| 2.2 Identify public-private partnership through multi-stakeholder approaches to avail and promote solar energy pumps and improved irrigation technologies to smallholder farmers | | | | | | | | | | | | | | | |
| 2.3 Conduct a multi-criteria GIS framework assessment to map potential agricultural water management investment areas based on climate, topography and aquifer characteristics | | | | | | | | | | | | | | | |
| 2.4 Develop appropriate and affordable methodology in using solar irrigation technologies along with improved agronomic management and soil moisture conservation technologies | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Research questions | | | | | | | | | | | | | | | |
| * 1. What are the existing initiatives and constraints of solar energy pumps and improved irrigation practices in Africa RISING intervention communities? | | | | | | | | | | | | | | | |
| * 1. Who are the reliable public-private partners to lead the development and dissemination of solar energy pumps and improved irrigation practices in the intervention communities? | | | | | | | | | | | | | | | |
| * 1. What are the solutions for potential agricultural water management investment for smallholder rural communities? | | | | | | | | | | | | | | | |
| * 1. What synergies exist among different actors that practice sustainable water resources management, improved agronomic, and soil conservation technologies? | | | | | | | | | | | | | | | |
| * 1. How do we scale and promote the developed methodology on agronomic, water management and soil and water conservation practices? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| The work utilizes survey data information on existing initiatives and practices of utilizing solar energy-based pumps and improved irrigation practices in Koutiala and Bougouni. This activity has been done in the previous season and will be repeated during the current season of the AR program. Its output will determine the design of solutions for agricultural water management investment options for the smallholder farming communities in its second-year study (2020/2021). GIS and Remote Sensing technologies along with climate information (e.g., solar radiation, number of sunshine hours etc.) will be employed to characterize and define suitable zones to implement solar-based energy pumps. Efficient water management solutions will be accompanied with other technologies (improved crop cultivars, soil and water conservation practices and agronomic packages) to evaluate the gains in productivity, environment, and economic, social, and human well-being of the sustainability options. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | Responsibility/Institute | | | | |
| Is the collected data part of a multi-year experiment? Yes | | | | | | | | | | |  | | | | |
| Land and soil characterization data ground truthed in 2020 | | | | | | | | | | | ICRISAT | | | | |
| Suitability maps on potential agricultural investment zones in different agro-ecologies (2020/2021) | | | | | | | | | | | ICRISAT | | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | Means of verification | | | | | | Date | |
| 6.1 A report on land and soil characterization of potential agricultural investment zones. | | | | | | | | Report uploaded on CGSPACE | | | | | | Mar. 2021 | |
| 6.2 Multi criterial decision making (MCDM) tool developed as a planning and management solutions to assess the potential of agricultural water management investments. | | | | | | | | Journal Article | | | | | | Jun. 2021 | |
| 6.3 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | | | Handbook revisions | | | | | | Oct. 2020 | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | |
| Domain | Indicator | | | Metrics/Scale | | | | | Approach used | | | Before intervention | | | After intervention |
| 7.1 Productivity | Crop Productivity | | | Grain yield and biomass (kg/ ha / season) at plot level. Farmer perceptions and ratings of technology yield performance as the result of the technologies at household level. | | | | | Survey | | |  | | |  |
| 7.2 Environmental | Soil moisture  Ground water level | | | # days during growing season without adequate soil moisture (from rain or irrigation) for crop growth at farm level.  Farm-level: Depth to shallow groundwater  Household: # months without adequate supply of clean drinking water (within 500m), Farmer perceptions of water availability.  Landscape level: % hh with year-round access to drinking water, % of livestock farmers with year-round access to water, % of irrigable land (given current investment) with sufficient irrigation water, % of streamflow not diverted for agriculture or drinking water. % of water sources (wells, streams) with clean water, % of population with year-round clean drinking water. | | | | | Survey | | |  | | |  |
| 7.3 Economic | Profitability | | | Net returns per unit labor input, land input, capital input, at plot level.  % of production sold (by crop, animal product), % of land allocated to cash crops at farm level. % of total income from agriculture, % of total consumption from own production at household level. | | | | | Survey | | |  | | |  |
| 7.4 Social | Equity  Level of social cohesion | | | Variability and distributions of productivity, income and assets at landscape level  Active farmer groups, active innovation platforms, % of community members participating in some form of social group, # of conflicts over resources. Presence of formal agreements for resource sharing at landscape level | | | | | Survey | | |  | | |  |
| 7.5 Human | Nutrition | | | Market supply of diverse food, Infrastructure (e.g. warehousing, access to markets/roads, irrigation; dependent on geography), Number of farmers experimenting the technology at landscape level | | | | | Survey | | |  | | |  |
|  | | | | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- |
| 8. How will scaling be achieved? | | | | | |
| Scaling is achieved through field demonstration of technologies perceived important by farmers. During phase I of the project we already established three solar pumped drip irrigation systems in the three technology parks. Farmers will be invited to witness the use of a combination of agronomic, soil and water conservation and improved irrigation technologies. The three sites will be demonstration places for research and capacity building activities. NGOs (AMEDD and FENABE) and farmers’ organizations will be beneficiaries of the technologies. Scaling out of the practices will be done through government extension systems, local and international NGOs and other donors who are willing to invest in the practices for the smallholder farmers. | | | | | |
|  | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | |
| This activity is linked to most agronomic, soil fertility improvements and soil and water conservation practices proposed in the sub-activities of the work plan. | | | | | |
|  | | | | | |
| 10. Custom indicators | | | | | |
| * Number of beneficiaries of solar-based water pumps * Amount and types of crops grown with solar-based water pumps * Type of business enterprises promoting solar-based water pumps | | | | | |
|  | | | | | |
| 11. Impact-based summary matrix | | | | | |
| 11.1 What is the development challenge you are addressing?  In rural Mali, agricultural production and productivity have been hampered by lack of reliable rainfall. In most cases, the number of dry spells exceeds two to three weeks and frequent occurrence of terminal droughts are hampering gains in productivity usually during grain filling periods. The presence of improved water management practices like that of solar-powered irrigation systems is ideal to avail the required water input for supplementary irrigation during the rainy season and production of high valued crops during the dry season. | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers in rural communities are the target groups. Also, suppliers of low-cost solar pumps and enterprises working on infrastructure development are targeted. | | | | | |
|  | | | | | |
| 12. Budget (US$) | | | | | |
| Outcome/Output/Activity | Sub-activity | **Budget line item** | **ICRISAT** |  |  |
| Outcome 1/Output 2/Activity 2 | MA1221-20 | Personnel | 24,000 |  |  |
|  |  | Services | 6,500 |  |  |
|  |  | Supplies | 3,500 |  |  |
|  |  | Capital |  |  |  |
|  |  | Travel | 3,500 |  |  |
|  |  | Overhead (17%) | 6,375 |  |  |
|  |  | **Total** | **43,875** |  |  |

1. Gantt Chart

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | | **Jun** |
| Data analysis and formatting |  |  |  |  |  |  |  |  |  |  |  |  | |
| Field data collection and analysis |  |  |  |  |  |  |  |  |  |  |  |  | |
| Continue towards development of the West Africa Handbook |  |  |  |  |  |  |  |  |  |  |  |  | |
| Scientific article writing and submission |  |  |  |  |  |  |  |  |  |  |  |  | |

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| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 2: MA2211-20** | | | | | | | | | | | | | | |
| Outcome 2: More farmers and farm families in the intervention communities are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition. | | | | | | | | | | | | | | |
| a. Output 2.2 | | | | Postharvest technologies and practices to provide options for the food, and feed sectors are tested and disseminated to farmers through researchers, extension staff, and development partners. | | | | | | | | | | |
| b. Activity 2.2.1 | | | | Introduce, evaluate, adapt and disseminate existing postharvest technologies and practices. | | | | | | | | | | |
| c. Sub-activity MA2211-20 | | | | Reduce vegetable postharvest losses through dissemination of Zero Energy Cool Chamber (ZECC), processing of vegetables in the dry seasonin Bougouni and Koutiala. | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | Institution | | | | | Role | | | | | | | | |
|  |  | | | | |  | | | | | | | | |
| Wubetu Legesse | Worldveg | | | | | Disease screening and laboratory analysis | | | | | | | | |
| Mahamadou Dicko | AMEDD | | | | | Community mobilization | | | | | | | | |
| Edoh Kokum | WorldVeg Consultant | | | | | Postharvest protocol design, data analysis and capacity building | | | | | | | | |
| Benedict Boyubie | IITA | | | | | Monitoring and evaluation/data management | | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | Institute | | | | | | Degree | | | Start | | | End | |
|  |  | | | | | |  | | |  | | |  | |
|  | | | | | | | | | | | | | | |
| f. Location(s) | | Bougouni and Koutiala districts | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | | September 2019 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| Vegetables are best stored in a cool and humid environment to prevent rotting and dehydration due to their high perishability nature. However, in rural areas farmers mainly store their harvested vegetables at ambient conditions leading to heavy postharvest losses as well as a loss of income due to lack or unaffordability of electricity to have cooling facilities. Moreover, limited occurrence of market days in such conditions forces farmers to sell off their products. A simple technology such as ZECC which creates cooling conditions without electricity can however best be recommended in the above-mentioned context to reduce postharvest losses of vegetables. ZECC technology is a small double-walled room, which can be made with locally affordable materials and whose cavity is filled with sand and maintained wet with water. The technology works on the simple principle of evaporation by lowering inside temperature of the chamber to 10-15°C and increase inside relative humidity of the chamber to 95% compared to ambient conditions. These conditions inside the ZECC extend shelf-life of vegetable for a long time (weeks). Besides good postharvest handling practices to extend shelf-life of vegetables, processing is another option to extend shelf-life and at the same time add value and increase market opportunities of fresh vegetables. The energy cooling chambers were installed in Mali and the data were collected during 2019-2020 dry season. The trial needs to be conducted in 2020/2021 dry season to enable multiyear data analysis and article writing. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 Compare the performance of different vegetable ZECC-based storage techniques to assess their suitability to extend vegetable produce shelf life | | | | | | | | | | | | | | |
| 2.2 Demonstrate farmer-affordable vegetable product processing techniques | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 Is ZECC an effective technology in extending vegetable produce shelf life compared to ambient storage conditions? | | | | | | | | | | | | | | |
| 3.2 What differences exist between ZECC-based storing techniques to extend the vegetable shelf over time? | | | | | | | | | | | | | | |
| 3.3 What are farmers affordable processing methods that enable storage of vegetable produce over long periods? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| Field experiments will be carried-out at Africa RISING technologies park (Bougouni and Koutiala). The genetic material (tomato, African eggplant and vegetable cowpea) used in sub-activity MA1114-20 will serve as products for postharvest tests and demonstrations. The field experiment layout on ZECC studies for each vegetable will be an RBD with 4 replications with four treatments: Vegetable stored in ZECC (T1), Vegetable mixed with shea butter wood ash (1:2 w/w) and stored in ZECC (T2), Vegetable mixed with shea butter wood ash (1:2 w/w) and stored in ambient conditions (T3) and Vegetable without any treatment and stored in ambient conditions (T4). Each district will be considered as a block and at level of each block, the experiment will be repeated two times over time (this totalizes to 4 replicates (2 blocks \* 2 times repeat of the experiment). Experiment will also be conducted to compare a chimney solar dryer to sun drying (farmers’ traditional practice of drying) with tomato and pepper using RBD design with 4 replicates where a district will be considered as a block and each drying experiment repeated two times at level of each districts. For the ZECC experiment, data on temperature and relative humidity inside ZECC or in ambient conditions, shelf-life, weight loss, and quality parameters (color, TSS, Acidity, Vitamin C) will be measured. For the drying experiment, data on drying rate, moisture content of the products (m.c) as well as color will be recorded. This data is collected because it is important to understand the trends that lead to crop quality loses. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded in Dataverse | | | | | | | | | | Responsibility/Institute | | | | |
| Is the data collected part of a multi-year experiment? Yes | | | | | | | | | |  | | | | |
| 5.1 Monitoring data on produce storage trial in the ZECC | | | | | | | | | | WorldVeg | | | | |
| 5.2 Data on shelf-life, weight loss, quality parameters (color, TSS, acidity, Vitamin C, and moisture content) | | | | | | | | | | WorldVeg | | | | |
| 5.3 Abiotic data: temperature and relative humidity inside ZECC or in ambient conditions and in the dryer | | | | | | | | | | WorldVeg | | | | |
|  | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | Means of verification | | | | | | | | Delivery date | |
|  | | | | |  | | | | | | | |  | |
| 6.1 Report on farmers field days & participatory selection of best postharvest technologies | | | | | Project report with list of participants disaggregated by sex included in the technical report submitted to IITA and copied to ICRISAT | | | | | | | | Mar. 2021 | |
| 6.2 Continue towards development of the West Africa Handbook | | | | | Periodic updates based on team inputs | | | | | | | | Oct. 2020 | |
| 6.3 Article on combined analysis of vegetables variety trials in Ghana & Mali. Submitted for publication. | | | | | Confirmation of submission of article to the journal of Sustainability or | | | | | | | | Oct. 2020 | |
| 6.4 Conference presentation on vegetable variety trials conducted in Mali and/or Ghana | | | | | Book of Abstract AAHC2020 conference | | | | | | | | Mar. 2021 | |
|  | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | |
| **Domain** | **Indicator** | | **Metrics/Scale** | | | | | | **Approach used** | | **Before intervention** | | | **After intervention** |
| 7.1 Productivity | Postharvest losses | | % weight loss and shelf-life | | | | | | Drying | |  | | |  |
| 7.2 Environment | Environmental conditions | | Relative humidity and Temperature in the ZECC and drying rate at plot level | | | | | | Automatic recording by data loggers | |  | | |  |
| 7.3 Economic | N/A | |  | | | | | |  | |  | | |  |
| 7.4 Social | N/A | |  | | | | | |  | |  | | |  |
| 7.5 Human | Food safety  Vegetable produce biochemical data | | Acidity, TSS, Vitamin C concentration and moisture; physical characteristic (color) | | | | | | Laboratory analysis | |  | | |  |
|  | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | |
| The training approach is the cascade training or training of trainers provided to extension agents, NGOs, vegetable retailers and food processors. Linkages with other NGOs activities willing to disseminate postharvest technologies to more beneficiaries in the same areas (AMEDD, EDUCO, WFP, GIZ, etc.). | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | |
| Vegetable products used for testing and demonstrations will be taken from the variety trial harvest in sub-activity MA1114-2001. The data collected from this trial will provide additional information on variety trials and vice versa. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | |
| * One article manuscript submitted in Oct. 2020 for publication in a peer-reviewed journal (Postharvest Biology and Technology) * 1 conference presentation | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Postharvest losses of vegetables were ranked as the top three major constraints in Mali. There are no affordable and effective storage techniques available to farmers. A simple technology such as ZECC offers cooling conditions without electricity. At hottest periods in the year, ZECC can lower the inside temperature of the chamber to 10-15°C and increase inside relative humidity of the chamber to 95% as compared to ambient conditions. The use of ZECC technology in this sub-activity aims at extending shelf-life of vegetables for a long time (weeks). Processing vegetables also offers another opportunity granted to farmers to extend shelf-life, add value and increase market opportunities of fresh vegetables. | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The beneficiaries are farmers in the intervention sites, food processing associations, vegetable retailers, extension agents and policymakers. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | |
| Outcome/Output/Activity | | | Sub-activity | | | | | **Budget line item** | | | | **WorldVeg** | | |
| Outcome 2/Output 2/  Activity 2 | | | MA2221-20 | | | | | Personnel | | | | 6,590 | | |
| Services | | | | 2,300 | | |
| Supplies | | | | 2,000 | | |
| Capital | | | |  | | |
| Travel | | | | 1,400 | | |
| Overhead (22.1%) | | | | 2,710 | | |
|  | | |  | | | | | **Total** | | | | **15,000** | | |

13. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | **2021** | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** |
| Organization of farmers training |  |  |  |  | |  |  |  |  |  |  |
| Data analysis |  |  |  |  | |  |  |  |  |  |  |
| Organization of farmers field day |  |  |  |  | |  |  |  |  |  |  |
| Participatory disease resistant  selection |  |  |  |  | |  |  |  |  |  |  |
| Technical report writing |  |  |  |  | |  |  |  |  |  |  |
| Continue towards development  of the West Africa Handbook |  |  |  |  | |  |  |  |  |  |  |
| Manuscript preparation and submission |  |  |  |  | |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 2: MA2221-20** | | | | | | | | | | | | | | | |
| Outcome 2: More farmers and farm families in the intervention communities are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition. | | | | | | | | | | | | | | | |
| a. Output 2.2 | | | | | Postharvest technologies and practices to provide options for the food, and feed sectors are tested and disseminated to farmers through researchers, extension staff, and development partners. | | | | | | | | | | |
| b. Activity 2.2.2 | | | | | Build capacity of farm families to reduce postharvest losses. | | | | | | | | | | |
| c. Sub-activity MA2221-20 | | | | | Train farmers on management of postharvest and processing technologies | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | Institution | | | | | Role | | | | | | | |
| Wubetu Legesse | | | Worldveg | | | | | Disease screening and laboratory analysis | | | | | | | |
| Mahamadou Dicko | | | AMEDD | | | | | Community mobilization | | | | | | | |
| Edoh Kokum | | | WorldVeg Consultant | | | | | Postharvest protocol design and data analysis & capacity building | | | | | | | |
| Benedict Boyubie | | | IITA | | | | | Monitoring and evaluation/data management | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | | Institute | | | | | | Degree | | Start | | | End | |
|  | | |  | | | | | |  | |  | | |  | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | | Bougouni and Koutiala districts | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | September 2020 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| Vegetables are best stored in a cool and humid environment to prevent rotting and dehydration due to their high perishability nature. However, in rural areas farmers mainly store their harvested vegetables at ambient conditions leading to heavy postharvest losses as well as a loss of income due to lack or unaffordability of electricity to have cooling facilities. Moreover, limited occurrence of market days in such conditions forces farmers to sell off their products. A simple technology such as ZECC which creates cooling conditions without electricity can however best be recommended in the above-mentioned context to reduce postharvest losses of vegetables. ZECC technology is a small double-walled room, which can be made with locally affordable materials and whose cavity is filled with sand and maintained wet with water. The technology works on the simple principle of evaporation by lowering inside temperature of the chamber to 10-15°C and increase inside relative humidity of the chamber to 95% compared to ambient conditions. These conditions inside the ZECC extend shelf-life of vegetable for a long time (weeks). Besides good postharvest handling practices to extend shelf-life of vegetables, processing is another option to extend shelf-life and at the same time add value and increase market opportunities of fresh vegetables. The energy cooling chambers were installed in Mali and the data were collected during 2019-2020 dry season. This sub-activity concerns providing capacity building to participating farmers on management of postharvest and processing technologies. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 Disseminate knowledge on vegetable on best postharvest management practices that reduce product losses during storage through training and practices. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research hypothesis | | | | | | | | | | | | | | | |
| 3.1 Training can provide farmers with knowledge and enable them to reduce postharvest losses during storage. | | | | | | | | | | | | | | | |
| 3.2 Farmer’s capacity to experiment can be enhanced through practices on the construction of postharvest storage facilities. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | |
| The training sessions on postharvest technologies will be conducted at Africa RISING technologies parks (Bougouni and Koutiala). The training topics will cover practical and theoretical session on: (i) the causes of vegetables product losses, (ii) how to build zero energy cooling chambers, (iii) management of ZECC, and, (iv) diverse processing techniques. Two sessions are planned in each district (Bougouni & Koutiala) during the dry season. Data will be collected on the number of participants segregated into sex and age, farmers’ preferences for treatments and the reasons for choosing an option. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded in Dataverse | | | | | | | | | | | Responsibility/Institute | | | | |
| Is the data collected part of a multi-year experiment? No | | | | | | | | | | |  | | | | |
| 5.1 Data on the number of participants receiving training, sex and age disaggregated. | | | | | | | | | | | WorldVeg | | | | |
| 5.2 Data on farmers’ preferences for postharvest treatments and the reasons for choosing an option. | | | | | | | | | | | WorldVeg | | | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | | | Delivery date | |
| 6.1 Report of the training sessions organized. | | | | | | | Summary report included in Africa RISING technical report. | | | | | | | Mar. 2021 | |
| 6.2 Project full report on postharvest options selection by farmers’ preferred options. | | | | | | | Report uploaded on CGSPACE. | | | | | | | May 2021 | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | |
| Domain | Indicator | | | | | Metrics/Scale | | | | Approach used | | Before intervention | | | After intervention |
| 7.4 Social | Farmers’ preferences for postharvest storage options | | | | | % farmers that approved postharvest storage options | | | | Group interview in each district | |  | | |  |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| The training approach is the cascade training or training of trainers provided to extension agents, NGOs, vegetable retailers and food processors. It is expected that partners attending the training sessions such as NGOs (AMEDD, EDUCO, WFP, GIZ, etc.) will ease knowledge transfer to more beneficiaries beyond project intervention zones. In May 2020, EDUCO, an NGO dedicated in children nutrition & education visited AR activities and farmers in Koutiala and wants to replicate them in Segou. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| This sub-activity is related to sub-activity MA2211-20. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | |
| * 1 conference presentation on Postharvest Biology and Technology | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  Postharvest losses of vegetables were ranked as the top three major constraints in Mali. Deficiencies of knowledge on adapted and affordable postharvest technologies are the major challenged faced by vegetable growers in Bougouni and Koutiala. It is expected that the project beneficiaries’ capacity will improve because the will have a better understanding of the procedures that lead to optimized uses of the technologies and extend products shelf life for more consumption and income. | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The beneficiaries are farmers in the intervention sites, food processing associations, vegetable retailers, extension agents and policy makers. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | |
| Outcome/Output/Activity | | | | Sub-activity | | | | | | **Budget line item** | | | **WorldVeg** | | |
| Outcome 2/Output 2/  Activity 2 | | | | MA2221-20 | | | | | | Personnel | | | 2,000 | | |
| Services | | | 3,000 | | |
| Supplies | | | 1,000 | | |
| Capital | | |  | | |
| Travel | | | 1,380 | | |
| Overhead (22.1%) | | | 1,620 | | |
| **Total** | | | **9,000** | | |

13. Gantt chart

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | **2021** | | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** |
| Organization of farmers for capacity building |  |  |  |  | |  |  |  |  |  |  |
| Organization of farmers field day |  |  |  |  | |  |  |  |  |  |  |
| Participatory disease resistant  Selection training |  |  |  |  | |  |  |  |  |  |  |
| Report preparation and submission |  |  |  |  | |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | | |
| **2020 Africa RISING W. Africa Activity Protocol –Outcome 3: MA3112-20** | | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | | | | | | | | | | | |
| 1. Output 3.1 | | Enabling policies and institutional arrangements to increase participation of farm families, especially women and youth in the output and input markets and decision-making are advocated for implementation by national governments, policy makers and development partners. | | | | | | | | | |
| 1. Activity 3.1.1 | | Review of existing policies and institutional arrangements affecting equitable access to production assets and markets | | | | | | | | | |
| 1. Sub-activity MA3112-20 | | Analyze the enabling environment including policies and institutional arrangements and intervention to identify factors that enable the inclusion of women and youth along irrigated vegetable value chain | | | | | | | | | |
|  | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | |
| Name | | Institution | | | Role | | | | | | |
| Thai Minh | | IWMI | | | The Senior researcher will be responsible for the systemic analysis of the scaling pathway for irrigated vegetable value chain in Ghana and Mali. She will carry out data collection and analysis on SI indicators mainly on social and human condition to evaluate holistic sustainability of the interventions | | | | | | |
| National Researcher Scaling Innovations (TBD) | | IWMI | | | The National Researcher will support the data collection on the systemic analysis component. | | | | | | |
| Jean Baptiste Tignegre | | World Veg | | | Contribution on vegetable value chain | | | | | | |
| Benedict Boyubie | | IITA | | | Support towards meeting project M&E requirements and FtF indicators while ensuring data upload on Dataverse | | | | | | |
| Birhanu Zemadim | | ICRISAT-Mali | | | Contribution on sub-activity conducted in Mali | | | | | | |
| Adams Abdulai | | STEPRI | | | Contribution to policy analysis in Ghana | | | | | | |
|  | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | |
| Name | | Institute | | | | | Degree | | Start | End | |
|  | | | | | | | | | | | |
| f. Location(s) | National Level in Ghana and Mali; link to ground level activities in Upper East Region, Ghana | | | | | | | | | | |
|  | | | | | | | | | | | |
| g. Start | September 2020 | | | | | | | | | | |
|  | | | | | | | | | | | |
| h. End | May 2021 | | | | | | | | | | |
|  | | | | | | | | | | | |
| **1. Justification** | | | | | | | | | | | |
| In addition to the Bhungroo solar-based irrigation system and drip irrigation, several other research have shown promise of using different water lifting technologies and irrigation management to support off-season vegetable, seed and irrigated fodder production (Okwany and Schmitter., 2016, Schmitter at al., 2016). Moreover, research has identified numerous constraints to expanding the use of irrigation technologies along the value chains. The heterogeneity of farmers and respective demographics influences the preferences for technologies and therefore the level of entrepreneurship. Barriers, which prevent smallholder farmers in Ghana and Mali from entering into or advancing along the value chains are highly contextual and vary within and between countries; some key identified challenges are: (i) insecurity of land tenure; (ii) lack of infrastructure (e.g. roads, access to electricity, well drilling); (iii) limited access to irrigation technologies and/or credit; (iv) lack of after-sale services (e.g. maintenance, spare parts); (v) lack of reliable markets (both in terms of the crop value chains and the technology supply chains), (vi) inadequate or poorly maintained irrigation infrastructure and (vii) changing demographics of people in agriculture (women and shortage of labor) (Nakawuka et al., 2018; Merry and Lefore, 2018; Lefore et al., 2019).    A systemic approach to the scaling of irrigation technology and water management solutions to enhance valuechain functionality is needed through addressing these systemic barriers. The systemic scaling approach helps to explore sustainable pathways to scaling so that irrigation technologies can better support sustainable intensification of household production systems, development of agricultural value chains, and resilience of food systems. To support systemic scaling of irrigation solutions for sustainable intensification, it is essential to conduct an enabling environment assessment to understand enablers and hinderers influencing farmers’ adoption of the technologies, so that measures are put in place to ensure success.  Currently, IWMI is implementing several related initiatives on **systemic scaling of small scale irrigation (SSI) in Ghana and Mali**. Systemic scaling includes (1) water suitability/accounting, (2) enabling environment assessment, (3) co-identification of value chain scaling pathway, and (4) multi-stakeholder dialogues. These research have been conducted under the scope of Africa Rising (Ethiopia), TAAT and ILSSI project.  IWMI therefore proposes the research on systemic scaling to better address the barriers to scaling and integrate irrigation technologies and water management innovations into the agricultural value chain to support sustainable intensification of household production systems in **Ghana and Mali**.  In **Mali**, under the scope of the TAAT project, the enabling environment assessment is being conducted to understand enablers and hinderers influencing farmers’ adoption of the irrigation technologies, so that measures are put in place to ensure successful scaling of irrigation; while the ILSSI project works on water suitability and accounting. Leveraging on this enabling environment assessment in Mali, IWMI proposes the research on contextualizing the enabling environment assessment for irrigated vegetable value chain in **Mali and Ghana**. **The enabling environment in an (irrigated) agricultural value chain is a set of policies, informal institutions, support services and other conditions that create or improve and maintain a general operational environment, bringing together value chain actors in a co-operative manner.** Understanding such micro and macro environments of households and value chains as well as its influence on the scaling of irrigation technologies is important when catalyzing the appropriate enabling environment for integration and scaling of the irrigation technology and water solutions in sustainable manners (Lefore et al., 2019). | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **2. Objectives** | | | | | | | | | | | |
| 2.1. Identify factors that enable the inclusion of women and youth along irrigated vegetable value chain, especially in the output and input markets for irrigated vegetable production | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **3. Research questions** | | | | | | | | | | | |
| 3.1. What characterizes the enabling environment that facilitates the participation of farm families, and enables the inclusion of women and youth along irrigated vegetable value chains? | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.)** | | | | | | | | | | | |
| The sub-activity is embedded in the action research outlined under the proposed systemic scaling pathway analysis in outcome 3.2 (GH3211-20). The **policy framework** and **intervention analysis** will involve a review of policy clusters which influence the scaling of irrigation technologies and irrigated vegetable value chain development. The analysis will proceed in six steps, namely: (i) development of an inventory of relevant and existing policy/intervention documents, (ii) individual policy/intervention analysis, (iii) policy/intervention cluster analysis, (iv) cross cluster analysis, (iv) overall analysis, and (v) validation of results.  The results from the policy framework and invention analysis will be consolidated through a synthesis analysis. The synthesis analysis will first characterize the enabling environment for scaling irrigation technologies and irrigated vegetable value chain development by reflecting on the results from analyses of policies and interventions, and draw inferences on:   * achievements and shortcomings in the technology scaling and irrigated vegetable value chain development; * alternative scenarios/solutions/models/approaches that could have addressed the shortcomings/constraints better; and * produce specific policy and implementation recommendations. | | | | | | | | | | | |
| **5. Data to be collected and uploaded on Dataverse** | | | | | | | | | **Responsibility** | | |
| ***Policy framework*** with different policy clusters including socio-economic development framework, rural and agricultural development, social and gender inclusion, irrigation and water resources management, vegetable production, private sector development, etc.   * Objectives, target areas and beneficiaries, implementation strategies and mechanisms, institutional arrangements, changes in policy framework, conflicts, gaps, shortcomings   ***Enabling and disenabling factors*** to farmers’ participation in irrigated vegetable value chain, drivers, and potentials solutions/recommendations  ***Interventions*** that support farmers’ participation and enable the inclusion of women and youth along irrigated vegetable value chains | | | | | | | | | IWMI | | |
| **6. Milestones** | | | | | | | | | | | |
| **Deliverables** | | | | | **Means of verification** | | | | **End date** | | |
| 6.1 Database and qualitative dataset on enabling environment facilitating the scaling of irrigation and water solutions | | | | | Dataverse | | | | June 2021 | | |
| 6.2 Report on enabling factors facilitating the inclusion of women and youth along irrigated vegetable value chain, especially in the output and input markets for irrigated vegetable production in Ghana and Mali | | | | | Progress and final report submitted to IITA | | | | July 2021 | | |
| **7. Sustainable intensification indicators (Still need help here)** | | | | | | | | | | | |
| **Domain** | **Indicator** | | **Metrics/**  **Scale** | | | **Approach used** | | **Before intervention** | | | **After intervention** |
| 7.3 Economic | Income increase from selling irrigated products | | Amount increased per dry season | | | Interviews | |  | | |  |
| 7.4 Social | Gender equity | | Rating of technologies by gender-friendliness at household level | | | Interviews | |  | | |  |
| 7.5 Human | Food security | | Food consumption from irrigated products | | | Interviews | |  | | |  |
|  | | | | | | | | | | | |
| **8. How will scaling be achieved?** | | | | | | | | | | | |
| Scaling will be achieved by series of stakeholder engagement and system scaling activities, including, but not limited to:   * Using co-generation of knowledge through on-farm demonstration to scale out innovative technologies; * Organizing stakeholder meetings with farmers and extension officers on the results of the trials and the preferred water lifting and application methods during the dry season; * Sharing research results and engaging with potential scaling partners such as regional offices of Ministry of Food & Agriculture (MoFA) and GIDA (Ghana Irrigation Development Authority), the Agriculture Sector Working Group (ASWG) once the technologies and scaling pathways are co-identified and verified; * Linking AR’s irrigation technology and value chain-based scaling pilots with relevant multi-stakeholder dialogues/platforms to integrate the scaling into the platforms’ agendas and to facilitate the systemic changes and capacity to enhance the scaling of irrigation technologies and water solutions   Developing and using fact sheets, workshops, policy briefs, as well as scientific papers to communicate to the wider public actors, practitioners and relevant stakeholders. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **9. How are the activities in this protocol linked to those of others?** | | | | | | | | | | | |
| This sub-activity experiment is linked to other work conducted by IWMI on water use within vegetable production systems. In addition, it is linked to sub-activities planned by the World Vegetable Centre under GH11.15-21 and GH1116-21. And by STEPRI on policy and institutional analysis. The outcomes of this research will help to disseminate irrigated vegetable production in the Upper East Region of Ghana and other similar areas in Ghana and beyond. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **10. Custom indicators** | | | | | | | | | | | |
| * Number of demonstrations established * Number of farmers trained * Number of field days organized * Number of meetings/workshops attended * Number of project reports produced * Number of 1 journal article submitted/published | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **11. Impact-based summary matrix** | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  This sub-activity will address the following major development challenges:   * highly vulnerable to the effects of climate change, while farmers are cultivating in marginal lands with low and erratic and are exposed to more frequent and longer dry spells and floods that threaten food security. * Social and gender norms hindering social inclusion, together with limitation in the physical environment obstruct the investment and expansion of irrigation. * Along the agricultural value chain, constraints to smallholders’ access to water management technologies and equipment as well as investment to irrigation include, but not limited to, under-developed irrigation value chains and capacities, under-developed irrigation supply chain, limited access to finance, energy, knowledge services to invest in irrigation, and weak input and output market linkages; * Government policies and programs are biased towards large-scale irrigation and production system and lag behind efforts of smallholder farmers and the private sector in AWM;   11.2 Who is your target audience, e.g. extension agents, farmers, or policy makers?  The most important audience include small-scale farmers, women and youth involving in farming, extension and development agents, policy makers and private sector who are working on irrigation and solar-powered products. | | | | | | | | | | | |
|  | | | | | | | | | | | |
| \*\*\*12 Budget: This budget is for both Ghana and Mali, thus the sub-activity has been replicated in Mali with no budget figures appended to the workplan. | | | | | | | | | | | |
| **12. Budget Line** | | | | **IWMI** | | | | | | | |
| Personnel | | | | - | | | | | | | |
| Services | | | | - | | | | | | | |
| Supplies | | | | - | | | | | | | |
| Capital | | | | - | | | | | | | |
| Travel | | | | - | | | | | | | |
| Overhead | | | | - | | | | | | | |
| **Total** | | | | - | | | | | | | |

**13. Gantt Chart**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2020** | | | | **2021** | | | | | | | |
| **Year/ Month** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Assessment of Africa RISING SI technologies |  |  |  |  |  |  |  |  |  |  |  |  |
| Policy framework analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Irrigation and irrigated value chain intervention analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Reflection, data analysis and report writing |  |  |  |  |  |  |  |  |  |  |  |  |

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| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 1).* | | | | | | | | | | | | |
| **2020 Africa RISING W. Africa Activity Protocol – Outcome 3: MA3212-20** | | | | | | | | | | | | |
| Outcome 3: Farmers and other value chain actors have greater and equitable access to production assets and markets (input and output) through enabling institutions and policies. | | | | | | | | | | | | |
| 1. Output 3.2 | | Options to expand accessibility of production assets and increase participation in household decision-making by disaggregated groups by gender.. | | | | | | | | | | |
| 1. Activity 3.2.1 | | Identify constraints to, and opportunities for increasing women and youth access to production assets in the target area. | | | | | | | | | | |
| 1. Sub-activity:MA3212-20 | | Co-identify value chain-based scaling pathways for irrigation technologies and water solutions with farmers and other actors of vegetable value chains in the Africa RISING sites in Mali and Ghana and link these sites and activities to ILSSI’s multi-stakeholder Dialogue Space on small scale irrigation in Mali | | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | Institution | | | Role | | | | | | | |
| Thai Minh | | IWMI | | | The Senior researcher will be responsible for the systemic analysis of the scaling pathway for irrigated vegetable value chain in Ghana and Mali. She will carry out data collection and analysis on SI indicators mainly on social and human condition to evaluate holistic sustainability of the interventions | | | | | | | |
| National Researcher Scaling Innovations (TBD) | | IWMI | | | The National Researcher will support the data collection on the systemic analysis component. | | | | | | | |
| Jean Baptiste Tignegre | | World Veg | | | Contribution on vegetable value chain | | | | | | | |
| Benedict Boyubie | | IITA | | | Support towards meeting project M&E requirements and FtF indicators while ensuring data upload on Dataverse | | | | | | | |
| Birhanu Zemadim | | ICRISAT-Mali | | | Contribution on sub-activity conducted in Mali | | | | | | | |
| Adams Abdulai | | STEPRI | | | Contribution to value chain stakeholder analysis | | | | | | | |
| e. Student(s) | | | | | | | | | | | | |
| Name | | | Institute | | | | Degree | | Start | | End |
|  | | |  | | | |  | |  | |  |
|  | | | | | | | | | | | | |
| f. Location(s) | National Level in Ghana and Mali; link to ground level activities in Upper East Region, Ghana | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | September 2020 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | May 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **1. Justification** | | | | | | | | | | | | |
| Farmer investment in irrigation conforms to value chain logic as it has dependency on income from the sale of irrigated crops for re-investing in irrigation and inputs (pumps, fertilizers, improved seeds, pesticides) in order to raise productivity (Adela et al., 2019; de Bont et al., 2019 and 2019a). Irrigation technology supply and services as well as access to well established and profitable output markets need to collide for farmers to see the value of investing in irrigation for their production system. Access to output market for agricultural products is a major factor determining farmers’ adoption of irrigation technologies. To support systemic scaling of technologies, it is essential to conduct an irrigated value chain analysis.  Specifically, the value chain analysis aims at understanding primary products and production-related factors to enhance sustainable production systems, market structure for agricultural products be produced and marketed in the chain, and the chain structure. The production system analysis emphasizes primary resources required for production, environmental consequences of resource exploitation, primary productivity, potential incomes generated for primary producers, and factors facilitating and inhibiting the production (Herman and Minh, 2020). The market analysis provides understanding of market demands and requirements for products to be successfully produced and marketed in the chain. The chain structure analysis investigates the chain’s functions, potential actors’ roles and relevant knowledge and experience, value addition and distribution, and governance to determine how to organize the chain. Within the systemic scaling approach, irrigated value chain analysis can generate a better understanding of the level of entrepreneurship, gender, and social inclusion barriers to entrepreneurship and the mechanisms by which scaling of appropriate irrigation technology can be better integrated into the value chains.  Currently, IWMI is implementing several related initiatives on co-identification of value chain scaling pathway to operationalize the systemic scaling approach at the grassroots level. These works have been done under the scope of Africa RISING project in Ethiopia. In Ghana, ILSSI has established and facilitated multi-stakeholder dialogues around scaling of small scale irrigation. Leveraging on ongoing projects’ efforts, IWMI proposes the research on contextualizing the systemic scaling for irrigation technologies in respect of relevant AR-specific value chains in targeted region or district in Mali and Ghana and linking these activities with ILSSI multi-stakeholder dialogues (in Ghana) to foster interactive learning among stakeholders and accelerate the impact of scale. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **2. Objectives** | | | | | | | | | | | | |
| 2.1 Understand value chain-based scaling potentials for irrigation technologies and water solutions along irrigated vegetable value chains | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **3. Research questions** | | | | | | | | | | | | |
| 3.1. How the systemic scaling of irrigation technologies and water solutions can be injected in agricultural value chains for sustainable intensification? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.)** | | | | | | | | | | | | |
| An action research approach will be used for research on Bhungroo and solar-based energy under the different drip irrigation system (GH1222-2), enabling environment, and value-chain-base scaling pathway for irrigation technologies. The action research consists of four interrelated steps: analyse, co-design and test, reflect and act, and engage. The **analysis step** includes a rapid assessment by an inter-disciplinary team from IWMI, using various methods such as semi-structure interviews with farmers and value chain actors, focus groups discussion with farmers, Water User Association, cooperative and cooperative union, in a combination with field observation and transaction walks, and consultation workshops with local relevant stakeholder. The assessment aims to:   * Investigate existing irrigation technologies and practices and farmers’ interests and willingness to adopt, * Understand irrigated value chain structure and function, * Investigate irrigation supply and output market, * Characterize the enabling environment at the local level, and * Identify technology opinions and scaling pathways.   In the **co-develop** step, stakeholder consultation workshops on scaling of water innovation within irrigated agricultural value chain will be organized to:   * Explore further the challenges, technology and scaling options/possibility, * Co-design technology demonstration with farmers (activity **GH1222-2**) * Explore possibilities to scale the demonstrated irrigation practices/technology to other irrigation schemes within community, from one community to other communities, and from one district to others, * Investigate conditions for successful scaling of irrigation practices, * Identify key value chain actors to be involved to enhance the successful scaling and how to involve them, * Identify local partners for collaboration in the scaling of water innovations, and * Plan the implementation of the demonstration and scaling possibilities with stakeholders.   The **reflect step** will be undertaken by the research team throughout the testing process to:   * Gather and analyze feedbacks from farmers and partners participating in the testing of demonstration and scaling pathways and integrating them into adapting the tested pathways, * Reflect on tested technologies and scaling pathway, how to continue with the tested scaling pathway, how local partners and participants appreciate the scaling approach, and how they react to it, * Incorporate these reflections into the new scaling pathways to be tested in the future, and * Prepare for the further stakeholder engagement process (see the next step).   The **engage step** will also be carried out throughout the action research process, aiming to interact with stakeholders and participants of the testing process, engage with the existing innovation platforms and multi-stakeholder dialogues at local and national level, and identify and involve new relevant actors and stakeholders. Specific activities in the engage step include, but not limited to:   * Organize technology awareness campaigns in the villages together with development agents, department/office of agriculture at district and regional levels and NGOs; * Link Africa Rising’s scaling pilots with ILSSI multi-stakeholder dialogues around SSI; * Engage private sector in demonstrating and supplying technologies within the communities; and * Share experience and lessons learnt with the district/regional/and national relevant multi-stakeholder platforms. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **5. Data to be collected and uploaded on Dataverse** | | | | | | | | | **Responsibility** | | | |
| * Vegetable value chain’s actors, their roles, and their relationships in the chain * Activities carried out by actors * Local input supply systems * Farmers’ production system and marketing channels * Local collection/trading systems * Vegetable market structure, demand and supply, opportunities, and trends * Private sector actors involving in supplying of irrigation equipment and water solutions * Irrigation technology and water solutions for scaling   Scaling options for Irrigation technology and water solutions | | | | | | | | | IWMI | | | |
|  | | | | | | | | | | | | |
| **6. Milestones** | | | | | | | | | | | | |
| **Deliverables** | | | | | **Means of verification** | | | | **End date** | | | |
| 6.1 Qualitative dataset on technology and scaling option and vegetable value chains in Ghana and Mali | | | | | Dataverse | | | | June 2021 | | | |
| 6.2 Report on the technology and scaling pathways co-identified two AR sites in Ghana and Mali | | | | | Project report to be published in CGSpace submitted to IITA | | | | July 2021 | | | |
| 6.3 Paper based on this year’s data and research on systemic scaling of irrigation technologies and water solutions along irrigated value chains | | | | | Correspondence with Journal about submission | | | | July 2021 | | | |
|  | | | | | | | | | | | | |
| **7. Sustainable intensification indicators (Still need help here)** | | | | | | | | | | | | |
| **Domain** | **Indicator** | | | **Metrics/Scale** | | **Approach used** | | **Before intervention** | | **After intervention** | | |
| 7.3 Economic | Income increase from selling irrigated products | | | Amount increased per dry season | | Interviews | |  | |  | | |
| 7.4 Social | Gender equity | | | Rating of technologies by gender-friendliness at household level | | Interviews | |  | |  | | |
| 7.5 Human | Food security | | | Food consumption from irrigated products | | Interviews | |  | |  | | |
|  | | | | | | | | | | | | |

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| **8. How will scaling be achieved?** | |
| Scaling will be achieved by series of stakeholder engagement and system scaling activities, including, but not limited to:   * Using co-generation of knowledge through on-farm demonstration to scale out innovative technologies; * Organizing stakeholder meetings with farmers and extension officers on the results of the trials and the preferred water lifting and application methods during the dry season; * Sharing research results and engaging with potential scaling partners such as regional offices of Ministry of Food & Agriculture (MoFA) and GIDA (Ghana Irrigation Development Authority), the Agriculture Sector Working Group (ASWG) once the technologies and scaling pathways are co-identified and verified; * Linking AR’s irrigation technology and value chain-based scaling pilots with relevant multi-stakeholder dialogues/platforms to integrate the scaling into the platforms’ agendas and to facilitate the systemic changes and capacity to enhance the scaling of irrigation technologies and water solutions * Developing and using fact sheets, workshops, policy briefs, as well as scientific papers to communicate to the wider public actors, practitioners and relevant stakeholders. | |
|  | |
| **9. How are the activities in this protocol linked to those of others?** | |
| This sub-activity experiment is linked to other work conducted by IWMI on water use within vegetable production systems. In addition, it is linked to sub-activities planned by the World Vegetable Centre under GH11.15-21 and GH1116-21. And by STEPRI on policy and institutional analysis. The outcomes of this research will help to disseminate irrigated vegetable production in the Upper East Region of Ghana and other similar areas in Ghana and beyond. | |
|  | |
| **10. Custom indicators** | |
| * Number of demonstrations established * Number of farmers trained * Number of field days organized * Number of meetings/workshops attended * Number of project reports produced * Number of 1 journal article submitted/published | |
| sss | |
| **11. Impact-based summary matrix** | |
| 11.1 What is the development challenge you are addressing?  This sub-activity will address the following major development challenges:   * highly vulnerable to the effects of climate change, while farmers are cultivating in marginal lands with low and erratic and are exposed to more frequent and longer dry spells and floods that threaten food security. * Social and gender norms hindering social inclusion, together with limitation in the physical environment obstruct the investment and expansion of irrigation. * Along the agricultural value chain, constraints to smallholders’ access to water management technologies and equipment as well as investment to irrigation include, but not limited to, under-developed irrigation value chains and capacities, under-developed irrigation supply chain, limited access to finance, energy, knowledge services to invest in irrigation, and weak input and output market linkages; * Government policies and programs are biased towards large-scale irrigation and production system and lag behind efforts of smallholder farmers and the private sector in AWM;   11.2 Who is your target audience, e.g. extension agents, farmers, or policy makers?  The most important audience include small-scale farmers, women and youth involving in farming, extension and development agents, policy makers and private sector who are working on irrigation and solar-powered products. | |
|  | |
| \*\*\*12 Budget: This budget is for both Ghana and Mali, thus the sub-activity has been replicated in Mali with no budget figures appended to the workplan. | |
| **12. Budget Line** | **IWMI** |
| Personnel | - |
| Services | - |
| Supplies | - |
| Capital | - |
| Travel | - |
| Overhead | - |
| **Total** | - |

**13. Gantt Chart**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2020** | | | | **2021** | | | | | | | |
| **Year/ Month** | **Sept** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** |
| Co-identify scaling pathways(incl. vegetable value chain analysis, farmer engagement, need assessment, training ) |  |  |  |  |  |  |  |  |  |  |  |  |
| Facilitating local stakeholders to carry on the value chain-based scaling pathways |  |  |  |  |  |  |  |  |  |  |  |  |
| Multi-stakeholder dialogues and engagement |  |  |  |  |  |  |  |  |  |  |  |  |
| M&E for verification |  |  |  |  |  |  |  |  |  |  |  |  |
| Reflection, data analysis and report writing |  |  |  |  |  |  |  |  |  |  |  |  |

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| **Planned work** | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 4: MA4111-20** | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | | | | | | | | | | | |
| a. Output 4.1 | | | | Alliances and effective partnerships developed between farmers, local communities, and research and development agents in the public and private sectors to enable the release, dissemination, and adoption of proven technologies and practices to scale. | | | | | | | | | | |
| b. Activity 4.1.1 | | | | Conduct cost-benefit and gender analysis coupled with other socio-economic analyses to identify and quantify adoption constraints and opportunities for different farmer contexts. | | | | | | | | | | |
| c. Sub-activity MA4111-20 | | | | Determine farmers’ preferences of technology attributes in cereal-legume systems of southern Mali. | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | |
| Name | | | Institution | | | Role | | | | | | | | |
| Felix Badolo | | | ICRISAT | | | Economic research design, field coordination, data collection, analysis and report writing on farmers’ preferences | | | | | | | | |
| Bekele Kotu | | | IITA | | | Overall coordination, collaborator economic research design, analysis and report writing on farmers’ preferences | | | | | | | | |
| Birhanu Zemadim | | | ICRISAT | | | Land and water specialist, identification and assessment of environmental attributes | | | | | | | | |
| Baloua Nebie | | | ICRISAT | | | Sorghum breeder, identification and assessment of productivity and other attributes of sorghum | | | | | | | | |
| Benedict Boyubie | | | IITA | | | Monitoring and evaluation/data management | | | | | | | | |
|  | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | |
| Name | | Institute | | | | Degree | | | Start | | | End | | |
|  | |  | | | |  | | |  | | |  | | |
|  | | | | | | | | | | | | | | |
| f. Location(s) | | Bougouni and Koutiala | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| g. Start | | September 2019 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| h. End | | May 2021 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | |
| Adoption of agricultural technologies usually takes long time or does not happen at the required level among smallholder farmers. This is partly because of the situation that technology development does not properly consider the traits of the technologies that farmers value most. In fact, limited adoption can happen when technology development process fails to incorporate the traits valued by farmers[[71]](#footnote-71),[[72]](#footnote-72). While the traits of technologies associated with both consumption and production may be important to guide decisions among smallholder farmers, most studies focus on either of them at a time. However, considering either consumption related traits or production related traits of technologies separately may not give the full picture on farmers’ preferences. In fact, unlike farmers in developed countries, smallholder farmers in developing countries are both producers and consumers of their own produce and hence they may evaluate technologies from both production and consumption angles before they decide to grow them. Meanwhile there are concerns nowadays that technology adoption is associated with unintended adverse effects on the farming system and livelihoods of smallholder farmers. A good example is the famous green revolution. While the green revolution could reduce rural poverty through rapid growth in productivity[[73]](#footnote-73), it was associated with negative environmental consequences such as water pollution, health problems, and loss of biodiversity[[74]](#footnote-74), [[75]](#footnote-75). This implies that sustainability is an important evaluation criterion in the process of technology development. Sustainable intensification entails the application of agricultural technologies (or technology packages) having multidimensional advantages/positive traits[[76]](#footnote-76). Therefore, assessing technologies with respect to farmers’ preferences considering the multidimensional nature of sustainable agricultural intensification is useful to set research priorities and guide policy interventions. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | |
| 2.1 The study will identify important traits associated with sorghum technologies as perceived by farmers. | | | | | | | | | | | | | | |
| 2.2 Assessing the differences in the technology preferences among farmers concerning gender and other farmer typologies. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | |
| 3.1 What are the traits of sorghum varieties liked by smallholder farmers in southern Mali? | | | | | | | | | | | | | | |
| 3.2 Are there differences among farmers’ categories (gender and typology) regarding preferences to technologies traits? | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | |
| We will collect data through a survey of about 600 randomly selected farm households in the three districts of southern Mali namely, Bougouni and Koutiala districts. We conducted focus group discussions in February 2020 to collect qualitative data on farmers’ preferences and related issues. The household survey data was planned to be conducted in the month of April 2020; however, the current COVID-19 restriction prevented the staff to be in the field and collect data, hence it was required to postpone the timing of data collection. Data analysis result from the focus group discussions will be used to design the household survey and prepare the questionnaire. The survey will be organized following a choice experiment design in which respondents are asked to choose from the list of different hypothetical technology options presented to them. The choice sets will be based on the discussions we made with farmers regarding the farming systems in southern Mali and the performances of various different agricultural technologies. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | Responsibility/Institute | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | |  | | | | |
| 5.1 Survey data (qualitative and quantitative) on farmers’ preferences | | | | | | | | | | ICRISAT | | | | |
| 5.2. Qualitative data; list of identified attributes based on focus group discussions | | | | | | | | | | ICRISAT | | | | |
|  | | | | | | | | | |  | | | | |
| 6. Milestones | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | | Delivery date | |
| 6.1 Data on Focus group discussions of farmers and key informants (one discussion group per village with on average 5 to 10 participants). | | | | | | | Qualitative data submitted to Dataverse repository. | | | | | | Jun. 2020 | |
| 6.2 Household survey report | | | | | | | Survey data submitted to Dataverse repository | | | | | | Feb. 2021 | |
| 6.3 Journal paper | | | | | | | Confirmation of Manuscript submission to African Journal of Economics | | | | | | May. 2021 | |
| 6.4 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | | Handbook revisions | | | | | | Oct. 2020 | |
|  | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | |
| Domain | Indicator | | | | Metrics/Scale | | | Approach used | | | Before intervention | | | After intervention |
| 7.1 Productivity | Crop Productivity | | | | Grain and biomass yield of sorghum (Kg/ha) at field level  Yield variability (CV, range), field level | | | Survey data | | |  | | |  |
| 7.2 Environmental | Soil fertility | | | | Qualitative measures (low/high), field level | | | Survey data | | |  | | |  |
| 7.3 Economic | Profitability | | | | Net income ($/ha), cost ($/ha), field level | | | Survey data | | |  | | |  |
| 7.4 Social | Social cohesion (collective action), equity | | | | Qualitative measure (low/high, % of farmers), household level | | | Survey data | | |  | | |  |
| 7.5 Human | Nutrition | | | | Qualitative measure (low/high), household level | | | Survey data | | |  | | |  |
|  | | | | | | | | | | | | | | |

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| 8. How will scaling be achieved? | | | | | |
| This study focuses on technology traits associated with consumption and production to guide farmers’ decisions for the application of the technology. The results of the study will help guide researchers to generate technologies that will have a high chance of adoption. It will also help the government extension department and other development practitioners to prioritize technologies for scaling and do proper targeting which will enhance adoption. | | | | | |
|  | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | |
| The study assesses technologies concerning farmers’ preferences to improve adoption. Therefore, this study is linked to activities on dual-purpose sorghum activities MA1113-20, and contour bunding technologies MA1212-20. | | | | | |
|  | | | | | |
| 10. Custom indicators | | | | | |
| * One paper submitted for publication in peer reviewed journal: Title ‘Farmers' preferences for technology attributes in cereal-legume systems: Evidence from a choice experiment in Mali’. Name of proposed Journal: Journal of Agricultural and Resource Economics. * One oral presentation at an international conference by December 2020. | | | | | |
|  | | | | | |
| 11. Impact-based summary matrix | | | | | |
| 11.1 What is the development challenge you are addressing?  Many agricultural technologies have been developed and are available, but many constraints considerably limit their adoption. Technology scaling is easier when technologies are compatible with farmers’ needs and this would happen when farmers’ technology preferences are taken into account in the process of technology development. One of the limitations in the agricultural research process is the fact that farmers’ preferences are usually overlooked. Moreover, farmers are not homogenous in their references while technology development mostly fails to take into account such heterogeneities among farmers. Such situations in the research process have resulted in low demands among farmers for new technologies, early dis-adoption, and sub-optimal adoption while making the scaling process quite challenging. This study addresses this challenge of adoption of agricultural technologies among smallholder farmers. | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Our study targets a large audience including: i) researchers to set research priorities and define the scaling strategies taking into account the farmers’ preferences; ii) extension agents for the technologies scaling on the fields; iii) policymakers to guide the policy interventions, and iv) farmers to make available the technologies that meet their needs in terms of consumption and production. | | | | | |
|  | | | | | |
| 12. Budget (US$). No new budget is required (carry over activity from previous year) | | | | | |
| Outcome/Output/Activity | Sub-activity | **Budget line item** | **ICRISAT** |  |  |
| Outcome 4/Output 1/  Activity 1 | MA4111-20 | Personnel | 0 |  |  |
| Services | 0 |  |  |
| Supplies | 0 |  |  |
| Capital |  |  |  |
| Travel | 0 |  |  |
| Overhead (17%) | 0 |  |  |
|  |  | **Total** | **0** |  |  |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month/ Week** | **2020** | | | **2021** | | | | | |
| **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** |
| Handbook revisions |  |  |  |  |  |  |  |  |  |
| Recruitment of enumerators and survey logistics |  |  |  |  |  |  |  |  |  |
| Household survey / data collection |  |  |  |  |  |  |  |  |  |
| Data analysis and technical report writing |  |  |  |  |  |  |  |  |  |
| Development of manuscript and submission |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol–Outcome 4: MA4311-20** | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations, and practices. | | | | | | | | | | | | |
| a. Output 4.3 | | | A framework for monitoring and evaluating technology adoption, and technology-associated risk accessible to the project team and scaling partners. | | | | | | | | | |
| b. Activity 4.3.1 | | | Monitor and modify the progress of technology adoption process towards scaling. | | | | | | | | | |
| c. Sub-activity MA4311-20 | | | Sustainable intensification in mixed crop and livestock systems and natural resource governance in southern Mali – Synthesis of interventions. | | | | | | | | | |
|  | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | |
| Name | | Institution | | | | Role | | | | | | |
| Augustine Ayantunde | | ILRI | | | | Sub-activity leader | | | | | | |
| Benedict Boyubie | | IITA | | | | Monitoring and evaluation/data management | | | | | | |
|  | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | |
| Name | | | | Institute | | | | Degree | Start | | | End |
|  | | | | | | | | | | | | |
| f. Location(s) | Bougouni and Koutiala districts | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| g. Start | July 2020 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| h. End | April 2021 | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | |
| Sustainable intensification of farming systems is influenced by the management of natural resources in the communities. Critical to healthy natural resource base are local institutions whether formal or informal as they are largely responsible for governance of common resources. Though Mali’s decentralization law was enacted in 1993 and became operational in 1999, there is still ambiguity regarding the roles of local institutions, both formal and customary in management of natural resources. For example, according to decentralization law, the communes (rural council) have a broad mandate to manage, improve, and conserve natural resources, as well as “maintain ecological equilibrium” but they have so far been granted very limited power over natural resources. Empowering local institutions in management of their natural resources is therefore essential to maintaining a healthy natural resource base for sustainable intensification of crop and livestock production systems. Local institutions of interest include local conventions especially as concern management of feed resources for livestock production, transhumance and conflict management. The local convention refers to an agreement – written or verbal – between two or more local actors, namely the social groups (socio–professional groups, associations, villages communities), the local administration (State’s representatives or decentralized bodies), the technical offices and NGOs which determines rules of access and utilization of natural resources. Since 2013, ILRI and AMEDD have carried out different interventions to strengthen the local institutions governing natural resource management in Africa RISING intervention communities such as elaboration and formalization of local conventions, demarcation of transhumant corridors or routes to avoid conflict, participatory analysis of conflict over natural resource use and building capacity of key stakeholders in conflict management in the intervention communities. Technical reports and journal publications have been published from the studies that have been conducted since 2013. However, these publications are rather dispersed and not focused on the broader picture of the linkage between sustainable intensification and natural resources management. A synthesis of various studies that have been conducted under the project in southern Mali is therefore is important to bring out key lessons and gaps, and recommendations from these interventions. Besides, a synthesis is necessary to address the broader issue of the impact of natural resource governance on sustainable intensification of the mixed crop and livestock systems in southern Mali. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | |
| 2.1 To prepare a synthesis of various natural resource governance interventions since 2013 in Africa RISING intervention communities in Bougouni and Koutiala districts including pertinent recommendations. | | | | | | | | | | | | |
| 2.2 To publish a manuscript on sustainable intensification and natural resource management in southern Mali. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | |
| 3.1 Does effective natural resource governance enhance sustainable intensification of mixed crop and livestock systems? | | | | | | | | | | | | |
| 3.2 Does strengthening of local institutions governing natural resource management foster social cohesion? | | | | | | | | | | | | |
| 3.3 What are the lessons that can be learnt and the gaps from various natural resource governance interventions? | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.). | | | | | | | | | | | | |
| This sub-activity will rely heavily on review of published materials from the various studies on natural resource governance and sustainable intensification in the intervention communities. If necessary existing data from the studies conducted under the project and other relevant ILRI-led projects in southern Mali will be re-analyzed to address the research questions. | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | Responsibility/Institute | | |
| Is the collected data part of a multi-year experiment/trial? N/A | | | | | | | | | |  | | |
| No new data collection | | | | | | | | | |  | | |
|  | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | Delivery date | |
| 6.1 Report of the perceived effect of the local conventions on natural resource management | | | | | | | Report to be published on CG Space | | | | Oct. 2020 | |
| 6.2 Synthesis on sustainable intensification of mixed crop and livestock systems and natural resource governance in southern Mali. | | | | | | | Report published on CG Space | | | | Dec. 2020 | |
| 6.3 Continue towards development of the West Africa Handbook. | | | | | | | Periodic updates based on team inputs | | | | Oct. 2020 | |
| 6.4 Prepare and submit a manuscript on Perceived impact of natural resource governance interventions on sustainable intensification | | | | | | | Journal article | | | | Feb. 2021 | |
|  | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | |
| Domain | Indicator | | | | Metrics/Scale | | | | | | | |
| 7.1 Productivity | N/A | | | |  | | | | | | | |
| 7.2 Environmental | N/A | | | |  | | | | | | | |
| 7.3 Economic | N/A | | | |  | | | | | | | |
| 7.4 Social | N/A | | | |  | | | | | | | |
| 7.5 Human | N/A | | | |  | | | | | | | |
|  | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| The synthesis document and manuscript will provide a means of sharing results from various natural resource governance interventions in the study sites with a wider audience which can facilitate scaling of promising innovations. The results of the study will be disseminated through different newsfeed channels and media platforms such as CG Space, Yammer and Research Gate. | | | | | |
|  | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | |
| This sub-activity can be linked to previous work on natural resource governance since 2013 and can inform Monitoring and Evaluation framework for scaling of Africa RISING technologies. | | | | | |
|  | | | | | |
| 10. Custom indicators | | | | | |
| * Synthesis report * Journal article | | | | | |
|  | | | | | |
| 11. Impact-based summary matrix | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed by this sub-activity is environmental degradation that comes from weak local institutions governing natural resource management which can impact on livelihoods of the local communities and food security. The formalized local conventions can therefore improve natural resource management and environmental health thereby impacting positively on household food security and resilience of the farming systems. | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Farmers, local government officials, natural resource management practitioners. | | | | | |
|  | | | | | |
| 12. Budget (US$) | | | | | |
| Outcome/Output/Activity | Sub-activity | **Budget line item** | **ILRI** |  |  |
| Outcome 4/Output 3/  Activity 1 | MA4311-20 | Personnel | 32,030 |  |  |
| Services | 6,000 |  |  |
| Supplies | 1,000 |  |  |
| Capital | 0 |  |  |
| Travel | 2,500 |  |  |
| Sub-total | 41,530 |  |  |
| Overhead (ILRI 15%) | 6,230 |  |  |
| Overhead (ICRISAT 17%) | 8119 |  |  |
|  |  | **Total** | **55,879** |  |  |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** |
| Draft report on perceived effect of local conventions on natural  resource management in southern Mali |  |  |  |  |  |  |  |  |  |  |
| Data compilation and literature review |  |  |  |  |  |  |  |  |  |  |
| Data Analysis |  |  |  |  |  |  |  |  |  |  |
| Manuscript preparation and submission |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 4: MA4312-20** | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI technologies, innovations and practices. | | | | | | | | | | | | | | | |
| a. Output 4.3 | | | | | A framework for monitoring and evaluating technology adoption, and technology-associated risk accessible to the project team and scaling partners. | | | | | | | | | | |
| b. Activity 4.3.1 | | | | | Monitor and modify the progress of technology adoption process towards scaling. | | | | | | | | | | |
| c. Sub-activity MA4312-20 | | | | | Assess the impact of Innovation Platforms on SI technology uptake in Africa RISING interventions communities. | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | |
| Name | | | Institution | | | Role | | | | | | | | | |
| Bougouna Sogoba | | | AMEDD | | | Activity leader | | | | | | | | | |
| Mahamadou Dicko | | | AMEDD | | | Data analysis and reporting | | | | | | | | | |
| Arouna Bayoko | | | AMEDD | | | Multi-stakeholder facilitation | | | | | | | | | |
| Gundula Fischer | | | IITA | | | Contribution to research protocol and technical report writing | | | | | | | | | |
| Benedict Boyubie | | | IITA | | | Monitoring and evaluation/data management | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | |
| Name | | Institute | | | | | | Degree | | | Start | | | End | |
| Gilbert Dembele | | AMEDD | | | | | | MSc | | | Feb. 2021 | | | Jun. 2021 | |
|  | | | | | | | | | | | | | | | |
| f. Location(s) | | Koutiala and Bougouni | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| g. Start | | September 2019 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | |
| During phase I of Africa RISING project in Mali, four Innovation Platforms (Ips) were established; two at the communal level and two at the district level. These IPs were used for learning, information exchange and technology dissemination. In 2019/2020, data analysis was finalized, and results revealed that technology adoption was dynamic and depended on the availability of technology at an affordable cost, its easiness of application and social acceptability. In 2020/2021 a manuscript will be developed considering impact of the developed IPs in technology dissemination and impact on strengthening and sustaining multi-stakeholder innovation platforms. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | |
| 2.1 To assess the impact of Innovation Platforms on farmers’ access to information and SI technology uptake | | | | | | | | | | | | | | | |
| 2.2 To improve adoption of SI innovation in intervention communities through advanced co-learning and exposure to validated technologies /innovations | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | |
| 3.1 What are the roles of innovation platforms vis-à-vis increased farmers’ awareness and adoption of validated technologies? | | | | | | | | | | | | | | | |
| 3.2 To which extent Innovation Platforms worked during the first phase of Africa RISING and improved farmers access to information on SI technologies and SI technology dissemination? | | | | | | | | | | | | | | | |
| 3.3 How would the lessons learned from innovation platforms feed into multi-stakeholder interest group meetings and help women and youth farmers to access SI innovations? | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, stakeholder meetings etc.) | | | | | | | | | | | | | | | |
| Focus group discussion and key informant interviews were conducted to assess the impact of innovation platforms on beneficiaries’ access to information and scaling of SI technologies in 2019/2020. Multi-stakeholder meetings were conducted in the four technology parks and at district level to understand knowledge gained from IPs and increase awareness of farmers on SI innovations. Information from farmer to farmer exchange visits and farmer field days were collected on the awareness of SI options. The activity for the year 2020/2021 will be consolidating the outputs and writing a manuscript for publication. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | | Responsibility/ Institute | | |
| Is the collected data part of a multi-year experiment/trial? No | | | | | | | | | | | | |  | | |
| No new data is to be collected | | | | | | | | | | | | |  | | |
|  | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | Means of verification | | | | | | | Delivery date | |
| 6.1 Publication on impact of IPs in technology dissemination and impact on strengthening and sustaining multi-stakeholder innovation platforms. | | | | | | | Confirmation of manuscript submission to the journal of Agriculture and Food Security | | | | | | | May 2021 | |
| 6.2 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | | Handbook revisions | | | | | | | Oct. 2020 | |
|  | | | | | | |  | | | | | | |  | |
|  | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | |
| Domain | Indicator | | | | | | | | Metrics/Scale | | | | | | |
| 7.1 Productivity | N/A | | | | | | | |  | | | | | | |
| 7.2 Environment | N/A | | | | | | | |  | | | | | | |
| 7.3 Economics | N/A | | | | | | | |  | | | | | | |
| 7.4 Social | N/A | | | | | | | |  | | | | | | |
| 7.5 Human | N/A | | | | | | | |  | | | | | | |
|  | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | |
| The results of the impact assessment will improve multi-stakeholder platform meetings and increase uptakes of technologies and innovations in intervention communities while farmers field days will increase the exposure of producers to SI technologies and increase their adoption by the latter. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | |
| This activity is linked to activities that are conducted in the technology parks and intervention villages. IPs are channels through which demand-driven action research is conducted and research results are communicated to village communities through IP channel. Hence this work plan is related to all implemented activities. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | |
| * Publication in Journal of Agriculture and Food Security | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed by this sub-activity is understanding the role of innovation platforms for technology scaling and how the knowledge gained from innovation platforms spill over to multi-stakeholder interest groups. | | | | | | | | | | | | | | | |
| 11.2. Who is your target audience, e.g. extension agents, farmers, or policymakers?  Extension agents, farmers, researchers and policymakers. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 12. Budget | | | | | | | | | | | | | | | |
| Outcome/Output/Activity | | | | Sub-activity | | | | | | **Budget line item** | | **AMEDD** | | | **IITA** |
| Outcome 4/Output 3/Activity 1 | | | | MA4312-20 | | | | | | Personnel | | 10,000 | | | 5,000 |
| Services | | 7,500 | | |  |
| Supplies | | 8,000 | | |  |
| Capital | | 0 | | |  |
| Travel | | 8,000 | | |  |
| Overhead (ICRISAT 17%) | | 5,695 | | |  |
|  | | | |  | | | | | | **Total** | | **39,195** | | | **5,000** |
| **Total** | | | | **44,195** | | | | | | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** |
| Literature review and refining of data |  |  |  |  |  |  |  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Preparation of a technical report |  |  |  |  |  |  |  |  |  |  |  |  |
| Continue towards development of the West Africa Handbook. |  |  |  |  |  |  |  |  |  |  |  |  |
| Manuscript production and submission to journal. |  |  |  |  |  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol–Outcome 4: MA4313-20** | | | | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships to ensure delivery and large-scale uptake of SI technologies and practices are established with farmers, local communities, and research and development partners in the private and public sectors. | | | | | | | | | | | | | | | | | | |
| a. Output: 4.3 | | | | An updated framework for monitoring technology adoption to be used by the project team and scaling partners available and accessible. | | | | | | | | | | | | | | |
| b. Activity 4.3.1 | | | | Monitor and modify the progress of technology adoption process towards scaling. | | | | | | | | | | | | | | |
| c. Sub-activity MA4313-20 | | | | GIS mapping of implemented technologies across different agro-ecologies and gender influence in technology adaptation and use in Bougouni and Koutiala districts of Mali. | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | | | |
| Name | | | Institution | | | | Role | | | | | | | | | | | |
| Bougouna Sogoba | | | AMEDD | | | | Activity Leader | | | | | | | | | | | |
| Francis Muthoni | | | IITA | | | | Contribute to GIS mapping to technologies | | | | | | | | | | | |
| Mahamadou Dicko | | | AMEDD | | | | Data analysis | | | | | | | | | | | |
| Gundula Fischer | | | IITA | | | | Contributing to protocol development and technical report writing | | | | | | | | | | | |
| Benedict Boyubie | | | IITA | | | | Monitoring and evaluation/data management | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | | | |
| Name | | Institute | | | | | | Degree | | | Start | | | | | End | | |
| Gilbert Dembele | | AMEDD | | | | | | MSc | | | Feb. 2021 | | | | | Jun. 2021 | | |
|  | | | | | | | | | | | | | | | | | | |
| f. Location(s) | | Koutiala and Bougouni | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| g. Start | | July 2018 | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| h. End | | June 2021 | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 1. Justification | | | | | | | | | | | | | | | | | | |
| Technology adoption by farmers is linked to changes in environmental and climate variations but also to the household socio economic status and the cultural acceptance of technologies. The reliability and replicability of the technologies depend on the specific context where technologies are developed and implemented. In the year 2019/2020, available technologies developed in phase I of the Africa RISING project and technologies validated in phase II were mapped and characterized using GIS and remote sensing technologies. Activities completed include change detection analysis on land use, land cover status from 2013 to 2018, and technology adoption status per villages in the two districts (Bougouni and Koutiala). The year 2020/2021 will be a time to consolidate the outputs of the GIS and remote sensing activities by producing two manuscripts. The manuscripts integrate change detection information along with gender influence in technologies uptake under different agro-ecological and socio-economic context. The manuscripts also include social and economic assessment for single and multiple technology adopters. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | | | |
| 2.1 To map and characterize Africa RISING technologies under different agro-ecologies and socio-economic settings. | | | | | | | | | | | | | | | | | | |
| 2.2 To assess gender influence in technology adaptation and use. | | | | | | | | | | | | | | | | | | |
| 2.3 To assess the social and economic impact of multiple interventions vis a vis of single intervention in target communities. | | | | | | | | | | | | | | | | | | |
| 2.4 To evaluate how the cereal and legume value chains have to function to ensure ecological and socio-economic resilience. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | | | |
| 3.1 To which extent Africa RISING technologies have been adopted under different socio-economic and environmental conditions in Mali? | | | | | | | | | | | | | | | | | | |
| 3.2 How does gender influence technology adaptation and use in intervention communities? | | | | | | | | | | | | | | | | | | |
| 3.3 What are the social and economic impacts of multiple interventions vis a vis of single intervention in target communities? | | | | | | | | | | | | | | | | | | |
| 3.4 What is the gap in the cereal and legumes value chains for resilience upgrading? | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | | | |
| The activity is a continuation of GIS and Remote sensing change detection analysis conducted in 2019/2020. Additional information on land use in 2019 will be included. Vector data (road, market, villages, water site) will be applied to better understand the site context of technology adoption. For each technology developed by the project the coordinates of farmers who participated in technology adoption will be projected on the developed map to analyze the spatial context of adoption. In the different villages, socio economic data on the households’ conditions and analyzed data on gender influence in technology uptake will be used along with GIS derived bio-physical information to develop manuscripts. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded on Dataverse | | | | | | | | | | | | Responsibility/Institute | | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | | |  | | | | | | |
| 5.1 GIS data on roads, markets, villages and water bodies. | | | | | | | | | | | | AMEDD | | | | | | |
| 5.2 Secondary data on technology adoption from Africa RISING database and previously published resources. | | | | | | | | | | | | AMEDD | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | | | | Means of verification | | | | | | Delivery date | | | |
| 6.1 GIS maps showing spatial extent of technology adoption | | | | | | | | | Maps uploaded on Dataverse | | | | | | Dec. 2020 | | | |
| 6.2 Manuscript on gender disaggregated technology adoption for Koutiala and Bougouni districts. | | | | | | | | | Confirmation of manuscript submission to Sustainability journal | | | | | | Feb. 2021 | | | |
|  | | | | | | | | |  | | | | | |  | | | |
| 6.3 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | | | | Handbook revisions | | | | | | Oct. 2020 | | | |
|  | | | | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators and metrics | | | | | | | | | | | | | | | | | | |
| Domain | Indicator | | | | Metrics/Scale | | | | | | | | Approach used | | Before intervention | | | After intervention |
| 7.1 Productivity | Yield  Cropping intensity (annual count) | | | | Net Primary Productivity, landscape level  # crops grown per year across a landscape  Plant population density of crops within a landscape | | | | | | | | Survey data  RS images | |  | | |  |
| 7.2 Environmental | Vegetative Cover  Erosion | | | | % vegetative and tree cover (end of wet season, end of dry season)  Erosion (t/ha/yr) (MUSLE or RUSLE) | | | | | | | | RS images | |  | | |  |
| 7.3 Economic | Profitability  Variability of profitability | | | | Contribution to regional or national GDP  % hh in community with profits < critical level | | | | | | | | Survey data | |  | | |  |
| 7.4 Social | Equity (Gender, Marginalized group)  Level of social cohesion | | | | Variability and distributions of productivity, income and assets  Active farmer groups  Active innovation platforms | | | | | | | | Survey data | |  | | |  |
| 7.5 Human | Nutrition  Nutrition Awareness | | | | Landscape supply of diverse foods (natural areas) – not on-farm  % hh with adequate nutrition knowledge | | | | | | | | Survey data  National database | |  | | |  |
|  | | | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | | | |
| The determination of the analogue sites and the adoption or adaptation condition will help to better orient the scaling up of different technologies developed by Africa RISING. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | | |
| Remote sensing and GIS will be used to map uptake of sub-activities conducted: MA1112-20, MA1113-20, MA1114-20, MA1121-20, MA1122-20, MA1211-20, MA1212-20, MA1221-20 and MA4311-20. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 10. Custom indicators | | | | | | | | | | | | | | | | | | |
| * Number of hectares under each technology * Number of farmers adopting specific technologies * Number of technologies available for dissemination * Two publications | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 11. Impact-based summary matrix | | | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  The development challenge being addressed by this sub-activity is understanding the agro-ecological classes where adoption of Africa RISING technologies took place | | | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  Extension agents, farmers, researchers and policymakers. | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | | | | |
| Outcome/Output/Activity | | | | | | Sub-activity | | | | **Budget line item** | | | | **AMEDD** | | | **IITA** | |
| Outcome 4/Output 3/Activity 1 | | | | | | MA4313-20 | | | | Personnel | | | | 12,000 | | | 10,000 | |
| Services | | | | 4,000 | | |  | |
| Supplies | | | | 3,000 | | |  | |
| Capital | | | | 0 | | |  | |
| Travel | | | | 4,000 | | |  | |
| Overhead (ICRISAT 17%) | | | | 3,910 | | |  | |
|  | | | | | |  | | | | **Total** | | | | **26,910** | | | **10,000** | |
| **Total** | | | | | | **36,910** | | | | | | | | | | | | |

13. Gantt Chart1

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | **2021** | | | | | |
| **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** |
| Continue towards development of the West Africa Handbook |  |  |  |  |  |  |  |  |  |  |  |  |
| Literature review |  |  |  |  |  |  |  |  |  |  |  |  |
| Mapping of technologies and change detection analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Socio-economic data analysis |  |  |  |  |  |  |  |  |  |  |  |  |
| Manuscript preparation and submission |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Planned work** | | | | | | | | | | | | | | | | | | | |
| *The planned activities are presented in the protocols. Activities under each protocol are aimed at achieving the outputs under the four outcomes in the project log frame (Table 3).* | | | | | | | | | | | | | | | | | | | |
| **2020 Africa RISING West Africa Activity Protocol– Outcome 4: MA4411-20** | | | | | | | | | | | | | | | | | | | |
| Outcome 4: Effective partnerships to ensure delivery and large-scale uptake of SI technologies and practices are established with farmers, local communities, and research and development partners in the private and public sectors. | | | | | | | | | | | | | | | | | | | |
| a. Output 4.4 | | | Knowledge sharing centers and learning alliances within existent local and regional institutions including development actors developed. | | | | | | | | | | | | | | | | |
| b. Activity 4.4.1 | | | Establish knowledge-sharing and learning alliances among scaling actors. | | | | | | | | | | | | | | | | |
| c. Sub-activity MA4411-20 | | | Manage the operations of four technology parks as hubs for research and demonstration in Bougouni and Koutiala. | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| d. Research team | | | | | | | | | | | | | | | | | | | |
| Name | Institution | | | | Role | | | | | | | | | | | | | | |
| Birhanu Zemadim | ICRISAT | | | | Activity leader | | | | | | | | | | | | | | |
| Tumaini Sidibe | FENABE | | | | Bougouni site coordinator and facilitator of multi-stakeholder interest group meeting | | | | | | | | | | | | | | |
| Mahamadou Dicko | AMEDD | | | | Koutiala site coordinator and facilitator of multi-stakeholder interest group meeting | | | | | | | | | | | | | | |
| John Nzungize | ICRISAT | | | | Contribute to scale best-bet technologies | | | | | | | | | | | | | | |
| Karamoko Sanogo | ICRISAT | | | | Data manager | | | | | | | | | | | | | | |
| Karamoko Traore | ICRISAT | | | | Agronomic training and field preparation | | | | | | | | | | | | | | |
| Benedict Boyubie | IITA | | | | Monitoring and evaluation/data management | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| e. Student(s) | | | | | | | | | | | | | | | | | | | |
| Name | Institute | | | | | | Degree | | | | Start | | | | | | End | | |
|  |  | | | | | |  | | | |  | | | | | |  | | |
|  | | | | | | | | | | | | | | | | | | | |
| f. Location(s) | Bougouni and Koutiala districts | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| g. Start | April 2017 | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| h. End | May 2021 | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 1. Justification: | | | | | | | | | | | | | | | | | | | |
| The Mali Africa RISING project is coordinated by ICRISAT in close collaboration with partner institutes. Four technology parks were established, two in Bougouni (Flola and Diaba villages), and two in Koutiala (M’Pessoba and N’Golonianasso villages). These parks have been used by participating institutes (ICRISAT, ICRAF, WorldVeg, and IER) to conduct controlled research experiments. Training programs have been conducted in the parks for local NGOs, national training centers and communities living in Africa RISING intervention villages. The parks have been used by other programs like the West Africa sorghum improvement program, the sorghum and millet dissemination project (ARDT\_SMS), and the groundnut improvement program for capacity building and outreach activities. Also, the establishment of the parks has integrated research and capacity building activities by the different project partners, for example by the UNDP land management program and the AfDB fusnded TAAT program. From phase I of the program, it was understood that the long-term sustainability of running innovation platforms was not very likely. In this case, the four technology parks have been utilized to conduct multi-stakeholder interest group meetings and this is to continue in the current year and beyond. Emphasis will be given to engaging more youth in research and scaling activities. The end goal is to formalize the four parks as unique community-level multi-stakeholder platforms for all programs conducted in the specific village. The social mobilization and activities in the parks will be guided by the local NGOs, AMEDD (in Koutiala) and FENABE (in Bougouni). | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 2. Objectives | | | | | | | | | | | | | | | | | | | |
| 2.1 Conducting integrated and multi-disciplinary research and scaling strategy on sustainable intensification program | | | | | | | | | | | | | | | | | | | |
| 2.2 Developing a research hub for validating Africa RISING technologies for wider dissemination, providing capacity building and short-term training programs | | | | | | | | | | | | | | | | | | | |
| 2.3 Provide a site for the multi-stakeholder interest group meeting | | | | | | | | | | | | | | | | | | | |
| 2.4 Provide information concerning proven technological practices and climate services to farmers, local NGOs and extension agents | | | | | | | | | | | | | | | | | | | |
| 2.5 Provide high-quality agricultural inputs (plant material, fertilizer etc.), and climate-smart water access facilities to farmers | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 3. Research questions | | | | | | | | | | | | | | | | | | | |
| 3.1 How suitable are technology parks as means for demonstration and experimentation? | | | | | | | | | | | | | | | | | | | |
| 3.2 What are the mechanisms involved when working with development partners to ensure success and innovation? | | | | | | | | | | | | | | | | | | | |
| 3.3 How can progress towards scaling be tracked and monitored and feedback received to inform the research components on what is working and what is not applicable? | | | | | | | | | | | | | | | | | | | |
| 3.4 How can the partnership model on inclusive monitoring and evaluation conducted by scaling actors be implemented in other areas beyond Mali? | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 4. Procedures (survey methods, gender disaggregation, treatments, experimental design, sample size, etc.) | | | | | | | | | | | | | | | | | | | |
| The four technology parks will be utilized by the research team for various research and dissemination strategies. At each site, scientists and implementing partner institutes will identify and determine the size of the field plot to implement the field trials. Training programs will be provided to participating farmer groups (particularly the youth and women groups) on the introduced technology before activity implementation. With the use of these technology parks and independently identified farmers’ fields, and according to the phase II proposal we are expecting to reach 3,928 households through research and capacity building activities in the year 2020/2021. Identified best-bet technologies will be scaled to approximately 18,362 households through development actors who are working with the Africa RISING program. The socio-economy group will monitor the adoption of identified technologies in farmers’ fields and conduct continuous monitoring and evaluation of the five sustainable intensification domains. In each technology park, a farmer field day will be organized to bring various groups of farmers (adult, youth, women etc.) together and create an opportunity to discuss the types of technologies introduced, the relevance and challenges among the farmer groups. Approximately 300 farmers are expected in each of the farmer field days and one-third of the invitee would be youth farmers. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 5. Data to be collected and uploaded | | | | | | | | | | | | | Responsibility/Institute | | | | | | |
| Is the collected data part of a multi-year experiment/trial? Yes | | | | | | | | | | | | |  | | | | | | |
| 5.1 All field trial data that include agronomic, land, soil and water management | | | | | | | | | | | | | ICRISAT | | | | | | |
| 5.2 All data related to training and farmers field visit | | | | | | | | | | | | | ICRISAT | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 6. Milestones | | | | | | | | | | | | | | | | | | | |
| Deliverables | | | | | | Means of verification | | | | | | | | | | Delivery date | | | |
| 6.1 Biophysical database on improved technological practices and participatory research in the technology parks. | | | | | | Implemented trials, metadata and database uploaded on Dataverse. | | | | | | | | | | May 2021 | | | |
| 6.2 Manuscript on approach to technology parks use, technology validation and dissemination, capacity building, and lessons from farmers’ field visit. | | | | | | Manuscript submitted to Agriculture and Food Security journal. | | | | | | | | | | Mar. 2021 | | | |
| 6.3 Finalization of the West Africa Handbook in collaboration with the co-authors as a team. | | | | | | Handbook revisions | | | | | | | | | | Oct. 2020 | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 7. Sustainable intensification indicators | | | | | | | | | | | | | | | | | | | |
| Domain | | Indicator | | | | | | Metrics/Scale | | Approach used | | | | Before intervention | | | | After intervention | |
| 7.1 Productivity | | N/A | | | | | |  | |  | | | |  | | | |  | |
| 7.2 Environmental | | N/A | | | | | |  | |  | | | |  | | | |  | |
| 7.3 Economic | | N/A | | | | | |  | |  | | | |  | | | |  | |
| 7.4 Social | | Social cohesion  Collective action | | | | | | % of community members participating in some form of social group at landscape level  Participation in a collective action group at household level | | Survey data | | | |  | | | |  | |
| 7.5 Human | | Capacity to experiment | | | | | | * Number of new practices being tested by type at farm level * Number of farmers experimenting * Number of men and women literate * Number of men and women with numeracy | | Survey data | | | |  | | | |  | |
|  | | | | | | | | | | | | | | | | | | | |
| 8. How will scaling be achieved? | | | | | | | | | | | | | | | | | | | |
| The technology parks are sites for technological innovation, demonstration and capacity building. Best-bet technological innovations will be scaled-up to farmers’ fields through farmers exchange visits and implementation of trials at farmers’ fields. Hence, technology parks are considered as ideal sites where scaling work starts. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 9. How are the activities in this protocol linked to those of others? | | | | | | | | | | | | | | | | | | | |
| The proposed crop-livestock activities in the current work plan were previously implemented in the technology parks and will be implemented in the same technology parks. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 10. Custom Indicators | | | | | | | | | | | | | | | | | | | |
| * Number of trainings conducted * Number of farmers trained (gender-disaggregated) * Number and types of technologies implemented * Number of visits made by development institutions * Number of farmers, field extension agents, and service techniques and other actors visited the parks during farmer field days | | | | | | | | | | | | | | | | | | | |
| 11. Impact based summary matrix | | | | | | | | | | | | | | | | | | | |
| 11.1 What is the development challenge you are addressing?  In rural Mali, technology adoption is hampered by lack of reliable technological validation options that include but not limited to researcher-developed technologies, farmers’ awareness to the developed technologies, farmers’ technical skills in adopting developed technologies and social and behavioral links among researchers, farmers and extension agents. On-station developed technologies will be reaching the farmers through technology parks developed within the agro-ecologies of farmers’ settings. Technology parks are also equipped with training facilities to provide the required technological trainings. This approach is ideal to introduce farmers to the developed technology and sensitize them through awareness programs to support the adoption of technologies. | | | | | | | | | | | | | | | | | | | |
| 11.2 Who is your target audience, e.g. extension agents, farmers, or policymakers?  The target audiences are farmers, extension agents, development projects working on resilience strategies. | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | |
| 12. Budget (US$) | | | | | | | | | | | | | | | | | | | |
| Outcome/Output/Activity | | | | Sub-activity | | | | | **Budget line item** | | | **ICRISAT** | | | **AMEDD** | | | | **FENABE** |
| Outcome 4/Output 4/Activity 1 | | | | MA4411-20 | | | | | Personnel | | | 30,000 | | | 2,500 | | | | 2,500 |
| Services | | | 5,500 | | | 4,000 | | | | 4,000 |
| Supplies | | | 3,500 | | | 1,000 | | | | 1,000 |
| Capital | | |  | | |  | | | |  |
| Travel | | | 3,500 | | | 2,500 | | | | 2,500 |
| Overhead (17%) | | | 7,225 | | | 1,700 | | | | 1,700 |
| **Total** | | | **49,725** | | | **11,700** | | | | **11,700** |
| **Grand total** | | | | **73,125** | | | | | | | | | | | | | | | |

13. Gantt Chart

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year/ Month** | **2020** | | | | | | | **2021** | | | | | | | |
| **July** | **Aug** | **Sep** | **Oct** | **Nov** | | **Dec** | | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** |
| Continue towards development of the West Africa Handbook |  |  |  |  |  |  | |  | |  |  |  |  |  |  |
| Running integrated and multi-disciplinary research and scaling strategy |  |  |  |  |  |  | |  | |  |  |  |  |  |  |
| Data collection |  |  |  |  |  |  | |  | |  |  |  |  |  |  |
| Conducting multi-stakeholder interest group meeting |  |  |  |  |  |  | |  | |  |  |  |  |  |  |
| Organization of field day |  |  |  |  |  |  | |  | |  |  |  |  |  |  |
| Farmers feedback session on technologies |  |  |  |  |  |  | |  | |  |  |  |  |  |  |
| Manuscript preparation and submission |  |  |  |  |  |  | |  | |  |  |  |  |  |  |

## Mali Consolidated budget (Budget figures need revision)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-activity** | **Leader** | **ICRISAT** | **ILRI** | **WorldVeg** | **IITA** | **IER** | **WUR** | **AMEDD** | **FENABE** | **Total** |
| Outcome 1: Farmers and farming communities in the project area are practicing more productive, resilient, and profitable and sustainably intensified crop-livestock systems linked to markets | | | | | | | | | | |
| MA1111-20: Evaluating crop simulation models using different fertility sources and climate model outputs to improve the productivity of sorghum | ICRISAT | 59,670.00 |  |  |  |  |  | 9,360.00 | 8,775.00 | 77,805.00 |
| MA1112-20: Understanding soil fertility management in cereal cropping systems in southern Mali | ICRISAT | 63,180.00 |  |  |  |  |  | 9,360.00 |  | 72,540.00 |
| MA1113-20: Testing adaptation of dual purposes sorghum hybrids in Mali to diversify options for crop-livestock integration | ICRISAT | 64,350.00 |  |  |  |  |  |  |  | 64,350.00 |
| MA1114-20: Evaluate and disseminate diseases, pests, postharvest and nutrition support technologies tested in 2019 to reduce pre- and postharvest losses and improve nutrition under rainfed and dry seasons. | ICRISAT | 18,720.00 |  | 81,215.00 |  |  |  | 7,020.00 |  | 106,955.00 |
| MA1121-20: Efficient feed utilization through improved feed troughs | ILRI |  | 53,161.00 |  |  |  |  |  |  | 53,161.00 |
| MA1122-20: Fodder production for improved ruminant production | ILRI |  | - |  |  |  |  |  |  | - |
| MA1131-20: Risk management and informed decision-making towards sustainable intensification of crop-livestock systems | WUR |  |  |  |  |  | 27,741.00 |  |  | 27,741.00 |
| MA1211-20: Determination of cropping management factors using empirical relations, GIS, and Remote Sensing tools in two agroecologies in Mali | ICRISAT | 42,705.00 |  |  |  |  |  |  |  | 42,705.00 |
| MA1212-20: Improving crop-livestock productivity and household income through the use of contour bunding and agroforestry options | IER |  |  |  |  | 40,085.00 |  |  |  | 40,085.00 |
| MA1221-20: Improved irrigation technologies for efficient and sustainable agricultural water management in rural Mali | ICRISAT | 43,875.00 |  |  |  |  |  |  |  | 43,875.00 |
| ***Sub-total Outcome 1*** |  | *292,500.00* | *53,161.00* | *81,215.00* |  | *40,085.00* | *27,741.00* | *25,740.00* | *8,775.00* | *529,217.00* |
| Outcome 2: More farmers and farm families are adopting technologies and practices to improve nutrition, food and feed safety, post-harvest handling and value addition | | | | | | | | | | |
| MA2211-20: Reduce vegetable postharvest losses through dissemination of Zero Energy Cool Chamber (ZECC), processing of vegetables and capacity building in Bougouni and Koutiala. | WorldVeg |  |  | 15,000.00 |  |  |  |  |  | 15,000.00 |
| MA2221-20: Train farmers on management of postharvest and processing technologies | WorldVeg |  |  | 9,000.00 |  |  |  |  |  | 9,000.00 |
| ***Sub-total Outcome 2*** |  | *-* | *-* | *24,400.00* | *-* | *-* | *-* | *-* | *-* | *24,400.00* |
| Outcome 4: Effective partnerships are built with farmers, local communities, and research and development partners in the private and public sectors to ensure delivery and uptake at scale of SI, technologies, innovations and practices | | | | | | | | | | |
| MA4111-20: Determine farmers' preferences of technology attributes in cereal-legume systems of southern Mali | ICRISAT | - |  |  |  |  |  |  |  | - |
| MA4311-20: Sustainable intensification in mixed crop and livestock systems and natural resource governance in southern Mali – Synthesis of interventions. | ILRI |  | 55,879.00 |  |  |  |  |  |  | 55,879.00 |
| MA4312-20: Assess the impact of Innovation Platforms on SI technology uptake in Africa RISING intervention communities | AMEDD |  |  |  | 5,000.00 |  |  | 39,195.00 |  | 44,195.00 |
| MA4313-20: GIS mapping of implemented technologies across different agro-ecologies and gender influence in technology adaptation and use in Bougouni and Koutiala districts of Mali | AMEDD |  |  |  | 10,000.00 |  |  | 26,910.00 |  | 36,910.00 |
| MA4411-20: Operation of four technology parks as hubs for research and dissemination in Bougouni and Koutiala | ICRISAT | 49,725.00 |  |  |  |  |  | 11,700.00 | 11,700.00 | 73,125.00 |
| ***Sub-total Outcome 4*** |  | *49,725.00* | *55,879.00* | *-* | *15,000.00* | *-* | *-* | *77,805.00* | *11,700.00* | *210,109.00* |
| Allocation for graduate study  Moumini Guindo (PhD candidate)  Karamoko Sanogo (PhD candidate)  Cheick Oumar Dembele (PhD candidate)  Moussa Camara (MSc candidate)  Gilbert Dembele (MSc candidate)  Sery Coulibali (MSc candidate)  Moussa Camara (BSc candidate) |  | 29,450.00 |  |  |  |  |  |  |  | 29,450.00 |
| **Grand total** |  | **371,675** | **109,040** | **105,615** | **15,000** | **40,085** | **27,741** | **103,545** | **20,475** | **793,176** |

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